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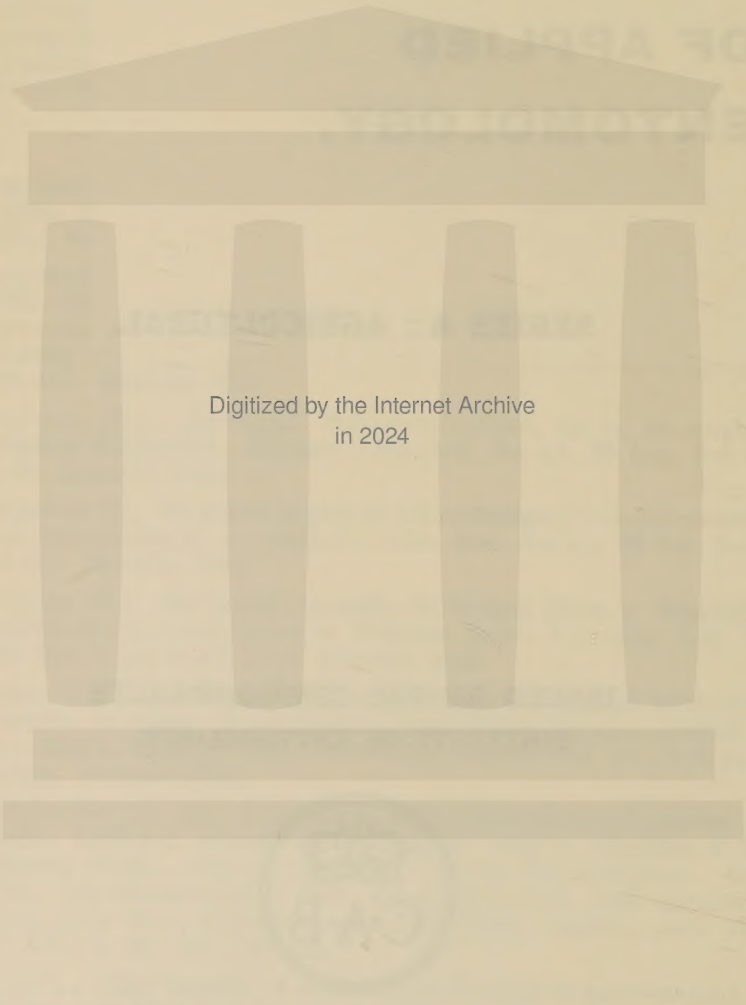

KAUFMANN (O.). **Die Gesunderhaltung der Rapspflanze als Mittel zur Vermeidung starker Rapsglanzkäferschäden.** [Cultural Measures as a Means of avoiding heavy Damage by the Rape Beetle.]—*Mitt. biol. Reichsanst.* no. 66, 36 pp. 1942. (Abstr. in *Tijdschr. PlZiekt.* **50** no. 3 p. 72. Wageningen, 1944.)

The author describes the growth of rape and shows that its potential yield is far above the actual, and that its power of regeneration following injury is great under favourable conditions. He also describes the damage due to the rape beetle [*Meligethes aeneus*, L.] in Germany and discusses at some length cultural measures designed to assist the plant to overcome it [*cf. R.A.E.*, A **31** 226].

LOOSJES (F. E.). **De gevoeligheid van Nederlandsche insecten voor derris.** [The Susceptibility of Dutch Insects to Derris.]—*Tijdschr. PlZiekt.* **51** no. 2 pp. 29–39, refs. Wageningen, 1945.

An alphabetical list based on the Dutch literature and the author's own investigations is given of upwards of 200 species of insects, chiefly pests of crops, showing their susceptibility to dusts and sprays of derris.

CROMBIE (A. C.). **On Competition between different Species of graminivorous Insects.**—*Proc. roy. Soc.* (B) **132** no. 869 pp. 362–395, 8 graphs, 87 refs. London, 1945.

The following is substantially the author's summary. The growth of pure populations of *Rhizopertha dominica*, F., *Oryzaephilus surinamensis*, L., and *Sitotroga cerealella*, Ol., was observed in a standard medium of wheat. This was maintained at a constant level by the periodic removal of " conditioned " frass and the addition of fresh grains. The population of each species rose to a maximum and remained fluctuating about this value indefinitely. A comparison of the rates of oviposition with the rates at which adults emerged showed that in the maximum population there was an enormous mortality (always over 90 per cent.) in the immature stages. When pairs of species competed, *Rhizopertha* eliminated *Sitotroga* because their larvae, between which most of the competition occurred, have the same needs and habits. Each of these species was able to survive with *Oryzaephilus* because the latter occupies a different " ecological niche ".

The Verhulst-Pearl logistic equation for the growth of population of a single species in a limited environment and the Lotka-Volterra simultaneous equations for the growth of population of two species competing for the same limited environment were fitted to the census data from all the experiments. The biological assumptions on which they are based proved to be true for practical purposes for *Rhizopertha* and *Sitotroga* populations. These assumptions are that the value of the potential rate of increase remains statistically constant and that all the factors inhibiting increase are linearly related to population density. Furthermore, a single factor, larval competition, was represented by the single indices standing for interspecific inhibition. It follows that the maximum population (or equilibrium position) should be independent of the initial population, and this proved to be so for all species. The Lotka-Volterra simultaneous equations did not always fit the observed points very well, but they were always successful in predicting the outcome of competition. It does not follow from this that these equations have any general validity. Their basic assumptions are by no means universally true and, unless they are shown to be so for a particular species under known environmental conditions, no biological deductions can be drawn from them. Where they do apply, they describe the course of change of population of two competing organisms

(303) Wt. P10/3764 4/46 S.E.R. Ltd. Gp. 432 [A]

with an accuracy that depends on the constancy of the coefficients involved. Two kinds of organism will be able to survive together only if they differ in needs and habits, *i.e.* occupy different ecological niches.

Populations living in a medium of unrenewed wheat rose to a maximum and then declined as the food became exhausted and " conditioning " increased. The eventual extinction of the population was due, not to the cessation of oviposition, but to the failure of the larvae to survive. The duration of life of adults of *Rhizopertha* was shorter in unrenewed than in renewed medium, and shorter still when this species was competing with *Sitotroga* in unrenewed medium. The duration of life of the other species and the sex ratio of *Sitotroga* were apparently unaffected by these conditions. The fecundity of *Rhizopertha* females decreased with time, and the lengths of *Sitotroga* adults of both sexes decreased in succeeding generations. The competitive relationship between *Oryzaephilus* and either *Sitotroga* or *Rhizopertha* shifted slightly in favour of the latter species in unrenewed as compared with renewed media. In a renewed medium this relationship probably depends chiefly on the destruction of eggs and pupae by adults and larvae, for which the more predacious *Oryzaephilus* is better placed. In an unrenewed medium the ability of the larvae to make the best use of the limited food-supply is the determining factor, and here the other two species have the advantage. The competitive relationship between *Rhizopertha* and *Sitotroga* remained the same in both media.

SOLOMON (M. E.). **Tyroglyphid Mites in Stored Products. Methods for the Study of Population Density.**—*Ann. appl. Biol.* **32** no. 1 pp. 71–75, 1 fig., 13 refs. London, 1945.

The following is based on the author's summary. The known methods for detecting the presence of Tyroglyphid mites in stored products are described. Sieving is recommended for coarse materials such as seeds, but for fine ones, such as flour, the examination of exposed surfaces or of samples in glass vessels for the tunnels made by the mites against the sides is more useful. The various methods of sampling to provide information about the density and extent of infestation are reviewed. Samples must generally be examined in the laboratory, and it is usually necessary to separate the mites from the medium containing them. With most media, this can be done by means of the modified Berlese funnel methods of Chernuishev [*R.A.E.*, A **27** 318] and Petrova [**31** 73] ; ways of overcoming certain disadvantages associated with them are suggested. Vigorous sieving is recommended for coarse materials, however, and a flotation method using dichlorethylene, which is described, for fine ones. It is usually less satisfactory to estimate the numbers by volumetric or gravimetric methods than to count the mites by placing them in a petri dish containing oil and resting on squared paper under a low-power binocular microscope, and a modification of this method for dealing with large numbers is described. The importance of stating whether population densities refer to the density at particular sampling points, the average density in the infested section, or the average density based on a series of samples taken at random or at regular intervals throughout the whole bulk is pointed out.

VAN EYNDHOVEN (G. L.). **Iets over het voorkomen van de meelmijt, *Tyroglyphus farinae* (L. 1758).** [Details of the Occurrence of the Flour Mite, *Tyroglyphus farinae*.]—*Ent. Ber.* **11** no. 247–249 pp. 51–54, refs. [Amsterdam] 1943.

The author reviews from the more important literature the numerous substances, largely stored products, from which *Tyroglyphus farinae*, Deg., has been recorded, with references to closely related species. He concludes that it prefers dry substances and briefly summarises the ways in which infestation is spread.

VAN OOSTSTROOM (S. J.). *Sciopus exul* **Parent (Dipt., Dolichopod.) in den Leidschen Hortus.** [*S. exul* in the Botanical Garden at Leyden.]—*Ent. Ber.* **11** no. 258, p. 196. [Amsterdam] 1944.

Adults of a Dolichopodid identified as *Sciopus exul*, Parent, have for many years been common in hothouses in the botanical garden at Leyden, Holland, and are predacious on small insects on the leaves of the plants. They were observed to destroy examples of *Trialeurodes* sp., which is common in the hothouses, and a Psocid. They also occur in hothouses in Amsterdam. Their habits, including the process of pairing, are briefly described.

VAN SLOGTEREN (E.) & DE BRUYN OUBOTER (M. P.). **Onderzoekingen over virus-ziekten in bloembolgewassen. I. Narcissen. 1.** [Investigations on Virus Diseases of Flowering Bulbs. I. *Narcissus*. 1.]—*Meded. Landb-Hoogesch. Wageningen* **45** no. 3, 32 pp., 17 pls. (1 col.), 18 refs. Wageningen, 1941. (With a Summary in German.)

Disease of *Narcissus* attributable to virus infection has long been known in Holland, and a detailed account is given in this paper of investigations on the symptoms in different varieties and the factors that influence transmission. Greenhouse and field experiments showed that transmission did not occur through the roots, and circumstantial evidence indicated that an insect was responsible, possibly *Aphis* (*Doralis*) *fabae*, Scop. This Aphid proved difficult to breed on *Narcissus*, but was later found in large numbers on one lot growing in the field in summer, among which disease was slowly spreading. It is stated in a footnote that subsequent experiments showed that the virus was readily transmitted by *Macrosiphum* (*Aulacorthum*) *solani*, Kalt., and less easily by *A. fabae* and *M. solanifolii*, Ashm. (*euphorbiae*, auct.) [*cf. R.A.E.*, A **27** 652]. *Myzus persicae*, Sulz., gave consistently negative results.

SUOMALAINEN (E.). **Zur Biologie von** *Dendrolimus pini* **L. (Lep., Lasiocampidae).** [The Biology of *D. pini*.]—*Ann. ent. fenn.* **10** no. 3 pp. 181–183, 4 refs. Helsinki, 1944.

A brief account is given of investigations in southern Finland in 1941–44 to ascertain whether the life-cycle of the pine Lasiocampid, *Dendrolimus pini*, L., is the same there as it is in Germany, where this moth has one generation a year, the overwintered larvae pupating in June. The progeny of a single female were bred through three generations on pine twigs in the laboratory and allowed to overwinter in damp moss in containers out of doors. The results showed that though most individuals completed their development in one year, some larvae overwintered twice and then gave rise to adults. Mortality was slight during the winter of 1941–42, which was consistently frosty, but heavier during the other two, when frost was only intermittent.

VAPPULA (N. A.). *Agrotis tritici* **L. und** *Mamestra oleracea* **L. (Lep., Noctuidae) als Schädlinge der Tomate in Gewächshäusern.** [*Euxoa tritici* and *Polia oleracea* as Pests of Tomatos in Glasshouses.]—*Ann. ent. fenn.* **10** no. 4 pp. 226–227, 2 refs. Helsinki, 1945.

Larvae of *Euxoa* (*Agrotis*) *tritici*, L., severed the stems of tomato plants in a glasshouse in south-western Finland in May 1943. The only example kept under observation pupated in mid-June and gave rise to an adult on 23rd July. It is thought that this Noctuid overwinters as a young larva and is most injurious in early summer. Little is known of its activities in Finland, but it has also been

observed there causing damage to onion. *Polia* (*Mamestra*) *oleracea*, L., is fairly common in southern and central Finland, but has so far caused little damage. It was recorded on peas in 1914 and on swedes in 1916 and injured the fruits of tomato in October 1940, the leaves and stems of tomatos under glass in May 1944 and cabbage in June 1944. The larvae from cabbage pupated in sand in mid-June, and the first adult was observed at the end of July. Some pupae were still present in October, however, so that the length of the pupal stage is apparently variable.

DEL CAÑIZO GOMEZ (J.). **El escarabajo de los patatales.** [The Potato Beetle.] —125 pp., 22 figs., 18 refs. Madrid, Minist. Agric., 1944. Price *Ptas* 2.

In this booklet, which is based largely on the literature, the author briefly describes the spread of *Leptinotarsa decemlineata*, Say, on potato in the United States and western Europe and gives a more detailed account of its recent invasion of Spain, where it was first observed in the region of the Pyrenees and has since spread to the south and west [*cf. R.A.E.*, A **33** 165], reaching the Portuguese frontier in 1943 and Estremadura and Andalusia in 1944. It has now become so firmly established that there is little hope of its being eradicated. The nomenclature of the beetle is reviewed, and descriptions are given of all stages and of its bionomics. The ways in which it is spread are discussed, and its natural enemies in the United States enumerated. About half the booklet is devoted to control measures, those dealt with including hand-collection, the destruction of infested plants, soil fumigation with carbon bisulphide, cultural practices, and the use of arsenical sprays and dusts of rotenone and barium fluosilicate. Directions are given for the preparation of sprays of Paris green, lead arsenate and calcium arsenate, and various types of apparatus suitable for applying them are described and illustrated.

SIMPSON (A. C.). **Control of Red Spider Mites.**—*Nature* **155** no. 3930, p. 241, 5 refs. London, 1945.

In view of the satisfactory control of Tetranychid mites on various crops in the United States given by 2, 4-dinitro-6-cyclohexylphenol [*cf. R.A.E.*, A **27** 650; **29** 249; **30** 133], and of the equally good results given by its dicyclohexylamine salt, which is less injurious to the plants [**29** 560], experiments were carried out against *Tetranychus telarius*, L., on hops and greenhouse tomatos in England. Two proprietary dusts and another including kaolin as filler, all of which contained 1 per cent. dinitro-o-cyclohexylphenol as the salt, and aqueous suspensions were used. The hops were treated in September, and the dusts were applied at the rate of $\frac{1}{3}$ lb. per plant. The percentages of mites dead were 9·8 for no treatment, 94–95 for the proprietary dusts, 82·3 for the kaolin mixture, 26·6 for flowers of sulphur, 98·4 and about 97 for aqueous suspensions containing 0·05 and 0·025 per cent. dinitro-o-cyclohexylphenol, 97·9 for one containing 0·025 per cent. as the salt, and 65·5 for 1 per cent. lime-sulphur, which is widely used by growers. The inclusion of 0·5 per cent. cuprous oxide or copper oxychloride in the second spray and 0·037 per cent. nicotine in the third did not reduce mortality below 91 per cent. The suspensions containing the lower concentration of the phenol or its dicycyclohexylamine salt gave 60–70 per cent. mortality of the eggs.

Only sprays were tested on tomatos, and the addition of a wetting agent was necessary. Suspensions containing 0·012 and 0·025 per cent. of the phenol as the salt gave 90·1 and 91 per cent. mortality and caused only slight injury to the plants, whereas the free phenol at a concentration of 0·025 per cent. killed the plants. Ammonium dinitro-ortho-cresylate killed the plants at concentrations too low to be lethal to the mites.

MASSEE (A. M.). **The Pests of Fruits and Hops.**—2nd edn., 8½ × 5½ ins., 283 pp., frontis., 26 pls., many refs. London, Crosby Lockwood & Son Ltd., 1945. Price 21*s*.

This second edition of a text-book on pests of fruit and nut trees, bush fruits, strawberries and hops in Great Britain is identical in subject matter and arrangement with the first [*R.A.E.*, A **25** 405], with the exception of minor amendments in some of the recommendations for control and the inclusion of a few additional ones in an appendix.

LEVER (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **16** no. 1 pp. 8–11, 15 refs. Suva, 1945.

Some 300 tons of rice that had been impaired by long storage in Fiji were found in July 1944 to be infested by beetles, of which *Calandra oryzae*, L., *Tribolium castaneum*, Hbst., and *Alphitobius laevigatus*, F., were the most abundant. The rice was fumigated with carbon bisulphide to control them, but subsequent fumigation with sulphur dioxide was more successful. A satisfactory kill of adults of *A. laevigatus* congregating in large numbers on concrete walls was obtained with a spray of 2 fl. oz. diesel oil and ¼ lb. lead arsenate in 3 gals. water. Anti-mosquito smoke spirals stated to contain pyrethrum and tobacco dust were damaged by *Lasioderma serricorne*, F., and larvae of *Catorama herbarium*, Gorh., were found boring in the bamboo parts of mah-jongg counters. *Necrobia ruficollis*, F., which had not previously been recorded in Fiji, and *N. rufipes*, Deg., were observed in August breeding in drying carcasses of cattle in two districts. The temperature averaged 77·5°F., but these species were taken in a sheep's carcass in New Zealand in late October 1944, when the temperature fell to 27·4°F.

Infestation of cabbages by *Crocidolomia binotalis*, Zell., has become more noticeable in recent years, owing to increased vegetable production, and notes are given on its distribution in Fiji and elsewhere and the appearance of the egg, larvae and adults. The damage is generally more severe on English cabbage than on Chinese cabbage (*Brassica chinensis*), which is less compact, and on a variety of the latter with more closely-folded leaves than in one in which they are more open. Other food-plants are Indian mustard (*B. juncea*) and Chinese radish (*B. sativus hortensis*), which are not severely damaged, and the ornamental verbenaceous shrub, *Clerodendron fragrans pleniflorum*. The egg, larval and pupal stages were found to last 4, 10–11 and 9–11 days, respectively, and pupation occurred in all cases in the soil. A spray containing 2 oz. cryolite in 3 gals. water gave satisfactory control of this Pyralid and of the diamond-back moth [*Plutella maculipennis*, Curt.], which is often associated with it on cabbages.

Dacus (*Chaetodacus*) *passiflorae*, Frogg., was reared from pods of cacao in Vanua Levu. The parasite of this Trypetid recorded in a recent paper [*R.A.E.*, A **33** 161] as an unidentified Braconid is here stated to be a Pteromalid, *Pachyneuron* sp. Predacious Capsids of the genus *Cyrtorhinus* collected in Fiji were nearly all identified as *C. fulvus*, Knight, which has been observed feeding on eggs of *Megamelus proserpina*, Kirk., embedded in the leaf-stalks of *Colocasia esculenta* [*cf.* **29** 170]. The only other species present was *C. riveti*, Cheesman.

MOUTIA (L. A.) & VINSON (J.). **Le charançon de l'*Eucalyptus*, *Gonipterus scutellatus*, Gyll.**—*Rev. Agric. Maurice* **24** no. 1 pp. 25–30, 1 fig., 5 refs. Port Louis, 1945.

Adults of the eucalyptus snout beetle, *Gonipterus scutellatus*, Gylh., were collected in Mauritius on various plants in and after August 1940, but were not identified until infestation of the leaves of *Eucalyptus* by adults and larvae

was observed in November 1943. In 1944, however, it was found to be distributed throughout the island wherever *Eucalyptus* was grown. The egg, larva and adults of both sexes of this weevil and the damage it causes are described, characters distinguishing *G. gibberus*, Boisd., from it are given, and its geographical distribution is reviewed. In Mauritius, the egg capsules each contained 8–12 eggs, which hatched after 6–10 days. The larvae fed on the parenchyma of the leaves for 14–31 days and then entered the soil and constructed cells of soil particles at a depth of about 2 ins. The prepupal and pupal stages lasted 29–38 days. Development was thus completed in from 49 to 79 days, according to the season, and there are at least four generations a year. All the species of *Eucalyptus* grown in Mauritius were attacked, but *E. robusta*, which has large leaves, was preferred. Natural enemies included birds, toads and an entomophagous fungus that attacks the adults, but none was of importance in control. No parasites were found in 2,000 egg masses and 800 larvae that were examined. The use of insecticides against the weevil is impracticable, owing to the height of the trees, and the importation of the egg-parasite, *Anaphoidea nitens*, Gir., from South Africa [*cf. R.A.E.*, A **32** 355] appears to be the only possible measure.

Box (H. E.). **Insect Transmission of the "Swollen-shoot" Virus in West African Cacao.**—*Nature* **155** no. 3942 pp. 608–609. London, 1945.

In experiments in 1943–44 to determine the vectors of the swollen-shoot virus disease of cacao in the Gold coast, four strains of the virus were used, of which only strain I was virulent. Plants infected by it developed swellings in the young woody growth and a typical mosaic in leaves produced after infection, and it caused the death, generally within 18 months, of plants infected when less than two years old. Strain II caused the development of swellings and sometimes an indeterminate chlorosis, and strains III and IV produced mosaic symptoms distinct from each other and those produced by strain I. In the experiments, *Ferrisia* (*Ferrisiana*) *virgata*, Ckll., and *Pseudococcus njalensis*, Laing (*exitiabilis*, Laing) [*cf. R.A.E.*, A **34** 46] transmitted strain I, *P. njalensis* strain II, and *P. citri*, Risso, strains III and IV. Neither the Aphid, *Toxoptera aurantii*, Boy., nor the Psyllid, *Mesohomotoma tessmanni*, Aulm., transmitted any of the strains [*cf.* **32** 26; **33** 66]. On the basis of these results, and to some extent on the differing symptoms produced in the plant, it is suggested that a complex of more than one distinct virus is involved. Recognisable symptoms first appeared five weeks after the insects had been transferred from the infected plants. In the course of many experiments, it was found that single females of *P. njalensis*, as well as the crawlers, are able to transmit strain I, and on one occasion it was transmitted by females that had lived on the infected plant for not longer than 48 hours. A minimum of ten females, preferably accompanied by crawlers, is, however, recommended to ensure transmission.

Lepesme (P.) & Villiers (A.). **Les longicornes du caféier en Afrique intertropicale.** —*Trav. Sect. tech. Agric. trop.* Sér. 1 pp. 27–70, 27 figs., 30 refs. Paris, 1944.

Descriptions are given of the adults of nearly fifty species of Longicorns that have been recorded from coffee in tropical Africa, with keys to them. Most of them do not primarily attack this crop, but are attracted to various native trees, and notes are given on the alternative food-plants, distribution and bionomics of these, with references to the source of the information. The bionomics of *Bixadus sierricola*, White [*cf. R.A.E.*, A **24** 75], *Anthores leuconotus*, Pasc. [*cf.* **28** 144] and *Dirphya* (*Nitocris*) *princeps*, Jord. [*cf.* **2** 275], which are important

pests of coffee in various parts of the area [*cf.* **23** 759], are dealt with in greater detail. The control measures recommended include keeping the plantations in a healthy condition, with a cleared space between them and the forest, destroying heavily infested plants, and killing the larvae by injecting petrol into the galleries and sealing them.

KIRKPATRICK (T. W.). **Timber Control. Notes on Insect Damage to East African Timbers.**—31 pp., 17 figs., 7 refs. Nairobi, E. Afr. War Supplies Bd., Timber Contr., 1944.

The author gives a general account of the principal types of insect damage to timber, the groups of insects that cause them and measures for preventing or limiting the injury, and some information collected during a short survey of timber yards and sawmills in Tanganyika, Kenya and Uganda, made because heavy damage by wood-boring insects had been reported in a consignment of railway sleepers from East Africa.

No information is available on the details of the life-history of any East-African wood-boring beetles, but living larvae of Buprestids and Longicorns were found at Molo (altitude 8,800 ft.) in timber that was said to have been cut over two years previously, indicating a very long developmental period, whereas it seems likely that Bostrychids can complete two generations, and on the coast possibly three, in a year. Bostrychids are the most important of the powder-post beetles in East Africa, where numerous species have already been found. Soft woods appear to be immune from attack, but in many hard-woods infestation spreads from the sapwood to the heartwood, and in at least one species (*Baikea minor*) it often starts in the heartwood. Lyctids do not seem to be common, though at least one species has been observed attacking *B. minor* and *Alstonia congensis* in Uganda. Anobiids are common pests of furniture and other wooden material in houses. Various species of Scolytids and Platypodids were observed, and other pests of timber known in East Africa include drywood termites, which have been observed only at the ports, and dampwood termites, of which the most injurious belong to the genus *Coptotermes* [*cf. R.A.E.*, A **31** 351].

A table showing the estimated susceptibility to Bostrychids of different woods and keys for the determination of the various types of insect damage to timber and of the common groups of insect pests of timber in East Africa are appended.

Plant Diseases and Pests.—*Rep. Dep. Agric. Bermuda 1944* pp. 7–8. [Hamilton] 1945.

The so-called disease of Bermuda cedar [*Juniperus bermudiana*] in Bermuda [*cf. R.A.E.*, A **33** 289] spread during 1944; the symptoms, which comprise the browning and dying of the foliage from the lower branches upwards, were most noticeable on shaded or overcrowded trees. A Scelionid parasite, determined as an undescribed species of *Inostemma*, was associated with *Contarinia juniperina*, Felt, one of the insects thought to be responsible [*loc. cit.*]. Mites were present on all the affected foliage from several areas that was examined and in some cases were so numerous as to suggest that they might be a major cause of the damage. A mussel-shaped Coccid was abundant in one area, but is not considered to be of primary importance.

Other insects recorded are *Gnorimoschema operculella*, Zell., which caused serious damage on late-planted potatoes, and *Halticus citri*, Ashm., which attacked *Talinum*, a spinach plant introduced from Florida.

Trujillo Peluffo (A.). **Insectos y otros parásitos de la agricultura y sus productos en el Uruguay.** [Insects and other Pests of Agriculture and Agricultural Products in Uruguay.]—9½ × 6½ ins., 323 pp., 195 figs., 43 refs. Montevideo, Fac. Agron. 1942.

This handbook on pests of plants and plant products in Uruguay deals mainly with insects but also includes short sections on Arachnida, Nematodes and Crustacea. In the first section (pp. 7–32), methods of controlling injurious insects are discussed, including mechanical and cultural measures and the use of insecticides, with information on many of the commoner chemicals used for this purpose. The main part of the book (pp. 33–291) contains descriptions of the characters of insects in general and of the various Orders dealt with, together with brief accounts of the appearance, bionomics and control of the numerous species that are pests in Uruguay, arranged systematically. Natural enemies of some of them are enumerated, and in the case of the Coleoptera and Hymenoptera, subsections on beneficial species are included. A list of 28 insects and a mite that have been declared to be pests of agriculture in Uruguay is appended.

Blanchard (E. E.). **Dos nuevos Icneumónidos, parásitos de** *Listroderes* **(Hym. Ichneum.).**—*Rev. Soc. ent. argent.* **12** no. 4 pp. 305–309, 2 figs. Buenos Aires, 1945.

The new species described are *Porizonidea* (*Porizon*) *argentinensis* from Argentina, and *P.* (*P.*) *parkeri* from Argentina and Uruguay. Both were reared from larvae of *Listroderes* in Argentina, and pupae were sent to the United States for use against *L. obliquus*, Gylh.

Baker (E. W.). **Mites of the Genus** *Tenuipalpus* **(Acarina : Trichadenidae).**—*Proc. ent. Soc. Wash.* **47** no. 2 pp. 33–38, 12 figs. Washington, D.C., 1945.

In this revision, the author points out that the genus *Tenuipalpus* should be restricted to a group of species allied to the type, *T. palmatus*, Donn., and that the name *Brevipalpus* (type *B. obovatus*, Donn.) should be reinstated for the other mites that have been included in the genus. The four new species described include *T. heveae*, sp. n., found on a leaf of rubber in Brazil.

Heinrich (C.). **The Genus** *Fundella* **Zeller : a Contribution toward a Revision of the American Pyralidoid Moths of the Family Phycitidae.**—*Proc. U.S. nat. Mus.* **96** no. 3190 pp. 105–114, 3 pls. Washington, D.C., 1945.

Descriptions are given of the genus *Fundella* and the five species (including one new one) that belong to it, with a key to the latter. All the species are American, and the two for which food-plants are known both attack Leguminosae. These are *F. pellucens*, Zell., of which *F. cistipennis*, Dyar, is a synonym, and *F. argentina*, Dyar, which was designated by Zeller as *F. pellucens* var. b. ; both have been found in Florida, the West Indies and Brazil, and *F. argentina* also in Argentina, Venezuela, Mexico and Texas. *F. pellucens*, recorded in the economic literature as *F. cistipennis* [*R.A.E.*, A **29** 345, etc.], is of some importance as a pest of pulse crops in tropical America ; it was found in Florida in 1941 and reared from lima beans there in 1944. Cowpeas are its preferred food-plant in Porto Rico, where it is common on lima beans but seldom damages them severely [**29** 345]. The literature records of *F. pellucens* [*cf.* **7** 58 ; **19** 13] cannot be verified without examination of the genitalia of specimens ; some of them probably refer to *F. argentina*.

JOHNSON (J. P.). **The imported Long-horned Weevil, *Calomycterus setarius* Roelofs.**—*Bull. Conn. agric. Exp. Sta.* no. 479 pp. 121–142, 16 figs., 27 refs. New Haven, Conn., 1944.

The Japanese weevil, *Calomycterus setarius*, Roel., was first recorded in New York in 1929 [*R.A.E.*, A **18** 454] and in Connecticut in 1932 [**21** 511], and has since been found in many districts in these two States and also in Illinois, Iowa, Maryland, Massachusetts, Pennsylvania and Rhode Island. Its systematic position is discussed, its distribution in Japan and the United States is reviewed and descriptions are given of all stages and of the female reproductive organs. Investigations on its bionomics and control were made in Connecticut in 1942–43. Eggs were not collected under normal conditions in the field, but were recovered from the soil in laboratory and field cages, where they were found in groups of up to five, at depths of an inch or less. Newly-emerged adults obtained from the soil in the field oviposited after seven days. Eggs laid on 21st–24th July hatched in 8–12 days. The larvae feed in the top two or three inches of soil from mid-summer until October, when they descend to lower levels to hibernate ; they were occasionally found as deep as 11 ins. in late autumn or early spring. In early April they return to the surface layers and feed until about mid-June, when they become full-grown. The larvae apparently feed on small roots and organic matter, but have never been observed to cause evident injury to plants ; they have been found in large numbers about the roots of the native aster (*Aster puniceus* var. *lucidulus*), *Lespedeza capitata* and *Desmodium canadense*, which are preferred food-plants of the adults, and also occur under lucerne, red clover (*Trifolium pratense*) and goldenrod [*Solidago*] and in turf. Pupae were found throughout June within an inch of the soil surface ; the pupal stage lasted about a week and was generally preceded by a prepupal period of 1–2 days. Adults occurred in the field from late June until late September or early October, but were most abundant in July and early August. Only females were observed, and evidence was obtained in the laboratory that reproduction is parthenogenetic. The adults are polyphagous and feed gregariously on the upper surface or edge of leaves and on flowers. The injury caused by them is described, and a list is given of some 100 plants on which they have been observed. Of the crop plants, lucerne, red clover and sea-kale beet (Swiss chard) are preferred [*cf.* **32** 96]. The adults are active and on emerging disperse from the area in which they developed ; they are unable to fly, but crawl considerable distances. They sometimes enter buildings and feed on house-plants or constitute a nuisance in other ways. They are also dispersed on clothing, vehicles, etc.

Experiments on control were carried out in 1943 in laboratory greenhouses at temperatures of 75–85°F, with adults placed on chrysanthemum foliage that had been treated with the material to be tested. A dust containing 25 per cent. cryolite in pyrophyllite gave complete mortality in preliminary tests in July, whereas the mortality from sprays containing cryolite, lead arsenate or pyrethrum was much less. In August, dusts containing 12·5 and 6·25 per cent. cryolite also gave complete control, but mortality at that time was also high on untreated plants, evidently owing to the natural decrease that occurs at that season.

HOUGH (W. S.). **Experiments with DDT for Control of Codling Moth and Comstock Mealybug.**—*Virginia Fruit* **33** no. 1 pp. 183–192. Staunton, Va., 1945.

An account is given of experiments in Virginia on the value of sprays containing DDT for the control of pests of apple. The sprays used comprised proprietary preparations, including Gesarol A-20 and Gesarol AK-20, in which the DDT was diluted and processed for use in the spray tank, and a

concentrate that was dissolved in ethylene dichloride and emulsified in water by means of potash fish-oil soap. All amounts are given per 100 U.S. gals. In laboratory tests, DDT at concentrations of about ½–1½ lb. gave far better control of larvae of the codling moth [*Cydia pomonella*, L.] than 4 lb. lead arsenate, and also a greater reduction in superficial injuries, and though its effectiveness was in general decreased somewhat by the addition of wettable sulphur, Bordeaux mixture or DN–111 [which contains a dicyclohexylamine salt of 2,4-dinitro-6-cyclohexylphenol], and still more by lime-sulphur, alone or with additional lime, and summer oil emulsion, it was still greater than that of lead arsenate in similar combinations. The effectiveness of DDT was slightly increased by the addition of Fermate [ferric dimethyl dithiocarbamate], while that of lead arsenate was decreased. Combinations of 3 or 1½ lb. lead arsenate with 3·2–8 oz. DDT were extremely effective against the larvae. DDT was toxic to the adult moths as a contact spray, though it acted slowly, but had little or no effect on the eggs. The deposits from sprays containing it were toxic to both adults and larvae.

In a field experiment in 1944, cover sprays containing 3 lb. lead arsenate were almost as effective as those containing 1 lb. DDT as regards infestation throughout the season and rather more effective than those containing 6·4 or 12·4 oz., but all DDT sprays gave much better control of superficial injuries, and seven cover sprays ending on 8th August, with DDT in the last five, were more effective than six ending on 24th July, with DDT in the last three.

In further laboratory tests, 1½ lb. DDT proved effective against young mealybugs on apples, but not against the mature females. It induced a gradual paralysis of the legs, which caused the young to drop from the fruits after 1–2 days, and the residue remained toxic, though its effectiveness had decreased after 12–13 days. In a field test with sprays containing about 1½ lb. DDT, the percentages of apples infested by Comstock's mealybug [*Pseudococcus comstocki*, Kuw.] at harvest, in late September, were 4 for two applications in May against the first generation and two in July against the second, 7·9 when the May treatments were omitted, 41·8 when the July treatments were omitted, and 3·5 for three applications in July and one in early August against the second generation, as compared with 69·4 in the rest of the orchard. Infestation by the European red mite [*Paratetranychus pilosus*, C. & F.] and *Tetranychus schoeni*, McG., increased very greatly on all trees sprayed with DDT.

A final test on the removal of DDT residues from the fruit showed that the methods usually employed for the removal of lead arsenate were relatively ineffective.

GRAHAM (C.). **Codling Moth Control by DDT Sprays.**—*Trans. Peninsula hort. Soc. 1944* pp. 20–24. Dover, Del. [1945.]

Comparative tests were made of the value of sprays containing DDT and the standard spray of lead arsenate against the codling moth [*Cydia pomonella*, L.] on apple in Maryland in 1944. The experiments were carried out on ten-year-old trees of three varieties on which a light crop had been very heavily infested in the previous year. The DDT was applied as Gesarol AK-20, which contains 20 per cent. All spray concentrations given are per 100 U.S. gals., and 3 oz. sodium lauryl sulphate was used as a spreader in all sprays containing DDT. After a calyx spray of 3 lb. lead arsenate, the percentages of apples infested and (in brackets) superficially injured were 24·6 (13·1) on trees receiving six cover sprays of 3 lb. lead arsenate with 1 U.S. gal. summer oil and 1 U.S. pint nicotine sulphate in the first, second, fifth and sixth, and 14·3 (3·1), 24·2 (3·9), 41 (5·1) and 27·7 (4·3), respectively, on those receiving six cover sprays of 1½, 1, and ½ lb. DDT alone and ½ lb. DDT with 1 lb. lead arsenate. The corresponding figures were 24·1 (4·6) when 1 lb. DDT was used for the

calyx and last five cover sprays, the first cover spray being omitted, and 17·3 (6·5) when it was substituted for the last two sprays of the standard (first) schedule. The final application in each series was made on 25th July, and since the greatest injury to fruit on all trees sprayed with DDT occurred after 10th August, infestation would probably have been considerably reduced by further applications on 10th and 25th August. No injury to the trees was observed, but the fruit of one variety showed a russeting that was thought to be most severe on trees sprayed with 1½ lb. DDT. A heavy infestation by the European red mite [*Paratetranychus pilosus*, C. & F.] developed about 1st August on all trees sprayed with DDT, but not in the rest of the orchard, which received four applications of oil. Experience with other insecticides has shown that the percentage of injury due to *C. pomonella* varies inversely with the size of the crop, but in these experiments it remained the same on trees sprayed with DDT, irrespective of size of crop, except where the lowest concentration (½ lb.) was used.

PORTER (B. A.). **New Insecticides for Codling Moth Control.**—*Trans. Peninsula hort. Soc. 1944* pp. 24–29. Dover, Del. [1945.]

The codling moth [*Cydia pomonella*, L.] has in recent years been increasing in abundance on apple in the United States owing partly to the development of strains that are resistant to lead arsenate [*cf. R.A.E.*, A **32** 362, etc.], and the efforts made over the last 20 years to discover a more effective insecticide that will not leave a toxic residue on the fruit are briefly reviewed. DDT has given improved control in all experiments so far carried out by the U.S. Bureau of Entomology, 1 lb. per 100 U.S. gals. being much more effective in many tests than 3 or 4 lb. lead arsenate, but it appears also to destroy beneficial insects, as populations of various mites have increased considerably following its use, and a similar increase in numbers of the woolly aphis [*Eriosoma lanigerum*, Hsm.] has been observed in the Pacific Northwest. The leaves of trees sprayed with it often become bronzed and withered, rather severe defoliation and dropping of fruit may occur, and in some cases the size of the fruit is reduced. These conditions are generally attributed to the large mite populations, but may be caused directly by the insecticide or by a combination of the two factors. The toxicity to man of the residue left on the fruit has not yet been determined; the deposit cannot be satisfactorily removed by the methods at present in use for lead-arsenate residues.

KENWORTHY (A. L.). **Methyl Bromide Fumigation Injury to Williams Apples.** —*Trans. Peninsula hort. Soc. 1944* pp. 62–65, 1 fig. Dover, Del. [1945.]

In 1944, an average loss of 75 per cent. occurred in apples of the Williams variety that had been fumigated with methyl bromide against the Japanese beetle [*Popillia japonica*, Newm.] in Delaware prior to shipment out of the regulated area. The losses were due to injury described as surface scald and internal brown discoloration, and the apples had been exposed in refrigerator cars for a period of two hours and kept under iced conditions for 16–24 hours prior to fumigation. No similar injury occurred in fumigated apples of other varieties or in Williams apples that were not fumigated. It is customary to determine the dosage of methyl bromide from a temperature representing the average of those at the top and bottom of the car, but investigations showed that a temperature-range of 25–30°F. may exist in a car and that the temperature of the fruit in the upper two layers of baskets may be 10–15°F. higher, and that at the bottom somewhat lower, than the temperature used to determine dosage. Injury was most severe in the upper layers of fruit.

A fumigation test was accordingly carried out to discover whether methyl bromide was the cause of the injury. In addition to Williams apples, two

other varieties of apple and one of peach were used, and the initial temperature of the fruit was either the same as or 20°F. higher than that at which the fumigation was performed (59°F.). After treatment, the fruit was left in the car for eight days, during which the car was re-iced as needed and the temperature did not exceed 55°F. It was then kept at room temperature for 24 hours. In the case of the Williams apples, surface injury developed within two days of fumigation and advanced internal injury in six. Surface injury was more severe when the temperature of the fruit was higher than that at which fumigation was performed, but advanced internal injury was not greatly influenced by this factor until the fruit was removed to room temperature, when it increased more rapidly in fruit that had been treated at the higher temperature. Descriptions are given of the types of injury observed. The other varieties of apple and the peaches were not affected by the treatment.

MACKIE (D. B.) & others. **Bureau of Entomology and Plant Quarantine.**—*Bull. Dep. Agric. Calif.* **32** no. 4 pp. 240–287. Sacramento, Calif., 1944.

Work on the eradication of *Dialeurodes citri*, Ril. & How., *Melanaspis obscura*, Comst., and *Nilotaspis halli*, Green, was continued in California in 1943 [*cf. R.A.E.*, A **32** 113]. Operations against *D. citri* were confined to the eradication of isolated infestations and the inspection of treated areas; this Aleurodid can be eradicated wherever it is found, and regulating the importation of its food-plants is considered to be the best method of keeping the State free from infestation. Pecan trees last fumigated with hydrocyanic acid gas against *M. obscura* in 1942 were examined four times, but no evidence of living Coccids was found; infestations on peach, plum, apricot and walnut were eradicated by means of oil sprays. No new infestation by *N. halli* was found in intensive surveys in seven counties. Marsh areas near infested properties were cleared in a search for self-sown seedlings of the food-plants, which were found in all ten areas examined, though none was infested. Measures against the olive scale (*Parlatoria oleae*, Colv.) comprised attempts to eradicate isolated infestations by the removal of food-plants and by intensive fumigation in the lower San Joaquin Valley; living Coccids were later found in about a third of the foci, although the food-plants in some had been cut back to the ground, and these were fumigated or sprayed. This lack of success is attributed to heavy infestation, the inability of the treatments to give complete mortality, and failure to treat a sufficiently large area.

Surveys in four counties to collect evidence of the distribution of the cherry fruit-fly, *Rhagoletis cingulata*, Lw., in association with *Prunus emarginata* [*cf. loc. cit.*] were unsuccessful, as no fruit was formed. The results of four years' study support the view that both this species and *R. fausta*, O.-S., are confined to the colder transitional and Hudsonian life zones [*cf.* **32** 114] and that their distribution in California, Oregon and Washington varies both in latitude and altitude. In California, the life zones that support *P. emarginata* are at altitudes considerably higher than those at which cherries are grown on a commercial scale.

The Oriental fruit moth, *Cydia* (*Grapholitha*) *molesta*, Busck [*cf.* **32** 114] was found to be so widely distributed in California that eradication was deemed impossible, and in July, southern California was placed under the quarantine regulations that apply to other infested States. In an extensive survey carried out in 36 counties by means of bait-traps, the adults were taken in eight counties, which are enumerated. Notes are given on the habits and importance of some of the other moths taken in the traps; they included *Bondia comonana*, Kearf., the larvae of which bore in resinous enlargements of the trunks of peach trees and occasionally enter the fruit. It overwinters in the pupal stage in a cocoon and was particularly common in the San Joaquin Valley. Adults were present throughout the season. In a survey for field

infestations, in addition to peach, *C. molesta* was found on apple, pear, loquat, three species of *Prunus*, two of *Cotoneaster*, *Cydonia japonica*, and *Photinia arbutifolia*, and laboratory experiments showed that the larvae can develop on twelve other plants, including pomegranate, grape, guava, persimmon (*Diospyros kaki*) and jujube (*Zizyphus jujuba*). Schedules for fumigation with methyl bromide already developed against *C. pomonella*, L., were modified to control *C. molesta* [see next abstract], and a list is given of a large number of fruits and vegetables that were treated during the year, including many that are not attacked, but were packed in used boxes that might contain cocoons. Injury from fumigation occurred only in cool weather, when some susceptible vegetables such as cucumbers and egg-plants [*Solanum melongena*] were damaged by the higher dosages used.

The application of sprays was continued to control the beet leaf-hopper [*Eutettix tenellus*, Baker] on its winter food-plants in the eastern Coastal Range Mountains and so reduce spring populations and protect beet and tomato in the valleys [*cf.* **30** 548]. The foci of maximum breeding tend to shift to the north in dry years and to the south in wet ones. An outbreak of *Anabrus simplex*, Hald., occurred in the Sierra Nevada mountains for the third year in succession [*cf.* **34** 25], an area of about 900 acres being affected; bait was distributed by aeroplane and, where this was too hazardous, by hand. Other pests recorded during the year include the mites *Eriophyes vitis*, Pgst., on grape-vines, and *Calacarus adornatus*, Keifer, and *Acaphylla steinwedeni*, Keifer, on *Camellia*; *Chrysomphalus bifasciculatus*, Ferris, which attacks many plants, including *Camellia*, ivy and *Euonymus*; *Diaspidiotus liquidambaris*, Kot., which is established on sweet gum [*Liquidambar styraciflua*] at one place and produces two generations each year, of which the first causes the development of galls on the leaves and the other overwinters on the stems; *Dynaspidiotus britannicus*, Newst., on box (*Buxus sempervirens* var. *suffruticosus*), infested plants of which were destroyed; *Diaspidiotus coniferarum*, Ckll., on cypress [*Cupressus*]; *D. ancylus*, Putn., on *Hydrangea*; *Asterolecanium arabidis*, Sign., on *Pittosporum* and *Veronica*; *Chionaspis etrusca*, Leon., on *Tamarix*; *C. wistariae*, Cooley, on *Wistaria*; *Lepidosaphes machili*, Mask., and *Pseudoparlatoria parlatorioides*, Comst., on orchids; a species of *Trionymus* closely related to *T. lounsburyi*, Brain, on hybrid *Amaryllis* in pots; *Phenacoccus solani*, Ferris, on *Echium*; *Tetraleurodes abutilonea*, Hald., on egg-plant; and *Glyptoscelis squamulata*, Crotch, which damaged grape-vines in the Coachella Valley [*cf.* **28** 344].

Coccids that commonly infest *Camellia* in California, given to some extent in order of importance, are *Parlatoria camelliae*, Comst., *Hemiberlesia degenerata*, Leon., *Aonidiella aurantii*, Mask., *H. lataniae*, Sign., *A. citrina*, Coq., *H. rapax*, Comst. (*camelliae*, Sign.), *Lepidosaphes camelliae*, Hoke, *Pulvinaria floccifera*, Westw., and *Chrysomphalus bifasciculatus*. Good control of *Parlatoria camelliae* was given by fumigation for two hours with methyl bromide at dosages of 2, 2½ and 3 lb. per 1,000 cu. ft. at temperatures of 80, 70 and 60°F., respectively, and relative humidities of 60 per cent. or more. If other Coccids are also present, the dosage should be increased by ½ lb. per 1,000 cu. ft. The plants were not harmed by the treatment unless they had young shoots or were freshly balled or the fibrous roots were exposed, but fumigation should not be carried out at temperatures below 60 or above 85°F. The second schedule applied to *Begonia* tubers gave complete control of *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., which increased on this plant in one coastal county, and is also the one now recommended against the azalea eriococcus [*Eriococcus azaleae*, Comst.]. One individual of *Aegeria* (*Sanninoidea*) *opalescens*, Edw., was taken outside the supposed limits of the infested area on an ornamental peach, which may have originated within it. Complete mortality of the larvae was given in tests by exposing peach trees with bare roots to methyl bromide for four hours at the rate of 2 lb. per 1,000 cu. ft. at 70°F. or 3 lb. at 60°. This fumigant also gives

effective control of *Nilotaspis halli* on nursery stock and scions at dosages of 2½ lb. per 1,000 cu. ft. at 80°F. and 3 lb. at 70°F. for exposure periods of two hours, or 2½ lb. at 60 or 70° for an exposure of three hours. Fumigation with 2½ lb. per 1,000 cu. ft. for two hours at 70°F. was completely effective against *Lepidosaphes gloveri*, Pack. Varieties of tulip and Dutch iris, and grape hyacinths [*Muscari*] and croft lilies [*Lilium longiflorum*) were all found to be tolerant of schedules involving exposure to dosages as high as 3 lb. for four hours at 70°F.

The report also includes sections dealing with the incidence of pests on various crops in different regions of the State and with pests intercepted at maritime ports and border inspection stations and within the State, and notes on revisions of State quarantine regulations.

MACKIE (D. B.). **One Year with the Oriental Fruit Moth.**—*Bull. Dep. Agric. Calif.* **33** no. 1 pp. 4–17, 3 figs. Sacramento, Calif., 1944.

Following the discovery of *Cydia molesta*, Busck, on peach in California in September 1942 [*R.A.E.*, A **32** 114], investigations, some of which have already been noticed [see preceding abstract] were made in 1943 on its habits there, its distribution in California and other western States, and methods of preventing or limiting its spread. The surveys showed that it was widely distributed in California, had extended its area of distribution in the central United States [*cf.* **33** 258] and also occurred in a small area in the State of Chihuahua, northern Mexico. Examination of peach trees at one place in California on 2nd August 1943, and of nectarines and a flowering peach at another on 28th September, showed the presence of larvae in the twigs of all three kinds of tree though none was found in the fruits. As peach orchards in California are irrigated, the growing season is long and luxuriant twig growth can develop late in the season. A list is given of 11 plants on which the moth completed its development in the laboratory and on some of which it was observed in the field.

C. molesta is readily controlled by fumigation with methyl bromide at concentrations that do not injure its host fruits, and, in compliance with quarantine regulations, fruit packed for transport to non-infested areas was fumigated. The dosages used between 1st May and 31st October 1943 were 2½, 2 and 1½ lb. methyl bromide per 1,000 cu. ft. at temperatures of 60–64, 65–69, and 70°F. and higher, respectively, for two hours; winter schedules had not been developed at the time of writing. The treatments were carried out beneath frames 8 ft. high covering an area of 100 sq. ft., over which gas-tight tarpaulins were placed. In preliminary work with a view to biological control it was found that *Gnorimoschema operculella*, Zell., could be used as a host for the rearing of *Macrocentrus ancylivorus*, Rohw. [**32** 211] and of *Glypta rufiscutellaris*, Cress., which ranks next to *Macrocentrus* in effectiveness against *C. molesta*.

KEIFER (H. H.). **Eriophyid Studies XIV.**—*Bull. Dep. Agric. Calif.* **33** no. 1 pp. 18–38, 14 figs., 1 ref. Sacramento, Calif., 1944.

In this part of a series [*cf. R.A.E.*, A **33** 111] the author erects two new subfamilies and ten new genera, describes ten new species, and gives keys to all the Eriophyid subfamilies and genera. Among the new genera are *Setoptus*, of which *Platyphytoptus jonesi*, Keifer [**26** 650] is the type, *Abacarus*, of which *Epitrimerus* (*Callyntrotus*) *hystrix*, Nal. [**31** 11], which was collected on *Elymus triticoides* in California in the autumn of 1943, is the only species, and *Aceria*. The author proposes to divide mites at present in *Eriophyes* among the three genera, *Eriophyes*, *Aceria* and *Cecidophyes*. Lists of the species of each are to be published in a subsequent part, but *Eriophyes* includes *E. vitis*, Pgst. (the

type) and *E. pyri*, Pgst., *Aceria* includes *E. tulipae*, Keifer (the type), *E. sheldoni*, Ewing, and *A. diospyri*, sp. n., which occurs in California under the bud scales and young fruit of persimmon (*Diospyros kaki*) and in the latter situation causes the fruit to become blackened at the end nearest the stem and to fall prematurely, and *Cecidophyes* includes *E. vermiformis*, Nal., which was recorded for the first time in North America in March 1941, when it was collected on filbert (*Corylus avellana*) in Oregon. It is an inquiline in terminal big buds caused by *Phytoptus avellanae*, Nal.

SMITH (R. F.) & MICHELBACHER (A. E.). **Alfalfa Insects in California.**—*Bull. Dep. Agric. Calif.* **33** no. 1 pp. 39–52, 13 figs., 18 refs. Sacramento, Calif., 1944.

Lucerne is a very valuable hay crop in California, but is subject to attack by insect pests throughout the growing season, and is sometimes severely damaged by them. Moreover, some insects transmit virus diseases, such as lucerne dwarf, of which *Draeculacephala minerva*, Ball, is a vector [*cf. R.A.E.*, A **30** 228], and as the plants are present throughout the year, the fields form reservoirs of infestation in winter from which other crops may be attacked. Owing to the favourable conditions that they provide, the fields support large populations of insects, including predators and parasites, and several of the pests are largely controlled by the latter, by fungus diseases, or by climatic conditions. The use of insecticides is generally impracticable owing to their cost, since each cutting represents a relatively small proportion of the year's yield, and to the risk of their use on a forage crop. It is therefore necessary to rely chiefly on cultural methods, the nature and effectiveness of which vary with local conditions. The development of resistant varieties of lucerne has shown promise [**30** 178].

Improvement in control measures requires that the effect of natural factors and cultural methods on the various pests and also the seasonal trends in infestation be accurately determined, and available information on lucerne pests in California is reviewed from this point of view. The most important is *Colias eurytheme*, Boisd. [*cf.* **32** 194; **33** 81]; *Prodenia praefica*, Grote [*cf.* **20** 693], is very destructive at times; and *Melanophus femur-rubrum*, Deg., *M. marginatus*, Scud., and *M. differentialis*, Thos., are frequently serious pests, but can usually be controlled by means of poison bait [*cf.* **28** 188], particularly when trap strips are baited. *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) may be abundant and injurious at the beginning of the growing season, and in central California it often causes the plants to become stunted and malformed. As a rule, only the first crop is damaged, since climatic conditions and natural enemies, which include *Hippodamia convergens*, Guér., Syrphids, Hymenopterous parasites and a fungus disease, usually exert control before the second becomes available. No satisfactory control measures are known against this Aphid on the first crop or when natural enemies are not effective, but cultural methods may be of some value [**22** 219].

Minor pests include *Hypera variabilis*, Hbst. (*postica*, Gylh.) [**29** 402; **33** 40], *H. punctata*, F. [**33** 241], *Sitona hispidulus*, F., which is common in the fields, but of uncertain importance since the larvae attack the roots, *Lygus hesperus*, Knight, and *L. elisus*, Van D. [**29** 441; **31** 202], *Laphygma exigua*, Hb., and *Plusia* (*Autographa*) *californica*, Speyer, the larvae of which are common on lucerne in central California, but have not been observed to cause damage, and *Diabrotica undecimpunctata*, Mannh. The last is very common on lucerne, and the adults and larvae are occasionally injurious in newly planted fields; no satisfactory control measures are known. Thrips, Membracids, Jassids and other insects are sometimes abundant in lucerne fields, but their importance has not been ascertained.

McKenzie (H. L.). **Miscellaneous Diaspid Scale Studies (Homoptera ; Coccoidea ; Diaspididae).**—*Bull. Dep. Agric. Calif.* **33** no. 1 pp. 53–59, 4 figs., 2 refs. Sacramento, Calif., 1944.

The new species described are *Hemiberlesia fraxini*, which injures *Fraxinus velutina* in California by removing the chlorophyll from the leaf tissue, *Melanaspis tenax*, which was intercepted in California on orchids (*Cattleya* sp. from Colombia and pseudobulbs of *Odontoglossum rossii* from Guatemala), and *Protodiaspis cinchonae*, which causes galls on the leaves of *Cinchona calisaya* in Bolivia. A list is given of some 30 plants on which *Chrysomphalus bifasciculatus*, Ferris, has been observed in California, including *Citrus* sp

Lange jr. (W. H.). **The Western Grape Leaf Skeletonizer *Harrisina brillians* in California.**—*Bull. Dep. Agric. Calif.* **33** no. 2 pp. 98–104, 5 figs., 12 refs. Sacramento, Calif., 1944.

A list is given of the seven species of *Harrisina* that occur in the United States, showing their distribution and food-plants, together with descriptions of all stages of *H. brillians*, B. & McD., which skeletonises the leaves of grape vines. It was first recorded from California in the summer of 1941, when it was found in San Diego County. The area infested in 1943 covered some 80 sq. miles, and the percentage crop losses in vineyards averaged 40–60. Attack appears to be sporadic, however [*cf. R.A.E.*, A **32** 114], and is not considered to be of outstanding importance, though quarantine measures were adopted to prevent its spread to other areas. Notes are given, chiefly from the literature, on the bionomics of this Zygaenid [*cf.* **28** 149 ; **32** 114]. Larvae received in September 1941 pupated within a month, and some adults emerged in October 1941, others in mid-August 1942 and one in February 1943. The protracted emergence is attributed to lack of moisture in the rearing jars. A. M. Boyce stated in correspondence that the larvae are very abundant on wild grape (*Vitis californica*) in California in late summer, and considers that there are three generations a year. In preliminary tests with sprays and dusts, also recorded by Boyce, the most effective were sprays of 4 lb. cubé (5 per cent. rotenone content) per 100 U.S. gals. water and nicotine sulphate (1 : 400 and 1 : 800) with a spreader, which gave 99, 98 and 90 per cent. mortality of the leaves, respectively, and a dust of cubé and Frianite (1 per cent. rotenone), which gave 95 per cent.

Service and Regulatory Announcements, July-September 1945.—*S.R.A., B.E.P.Q.* no. 164 pp. 39–49. Washington, D.C., U.S. Dep. Agric., 1945.

Administrative Instructions (B.E.P.Q. 542) relating to Quarantine no. 56 against pests of fruit and vegetables and effective from 1st October 1945 authorise the entry into the United States from Mexico of commercially sound fruits of orange, grapefruit and Manila mango provided that they have been subjected, under the supervision of an inspection, to the vapour-heat treatment against fruit-flies [*Anastrepha*] already noticed [*R.A.E.*, A **33** 396].

Other information in this part includes a supplement to a summary of plant-quarantine import restrictions in the Dominican Republic [**24** 803].

Foster (W. R.). **Diseases and Pests of Cereals, Fibre, Forage, and Root Crops.**—*Circ. Dep. Agric. B.C.* no. 17, 52 pp., 13 figs. Victoria, B.C., 1942.

This circular deals mostly with diseases, but includes brief sections on the control of insect pests of agricultural crops in British Columbia, the damage they cause, and the appearance and life-history of some of them.

CHAMBERLIN (W. J.). **Entomological Nomenclature and Literature.**—2nd edn., $10\frac{3}{4} \times 8\frac{1}{4}$ ins., xi+135 pp., frontis., many refs., multigraph. Ann Arbor, Mich., Edwards Bros., Inc., 1946.

The scope of the first two parts of this text-book is the same as in the first edition [*R.A.E.*, A **29** 625], but the lists of publications are extended, and the test questions are omitted. A third part (pp. 121–135) is added dealing with the composition of papers on scientific subjects and their preparation for publication.

HULL (R.) & WATSON (M. A.). **Virus Yellows of Sugar Beet.**—*Agriculture* **52** no. 2 pp. 66–70, 2 pls. London, 1945.

Infection of sugar-beet by virus yellows, the symptoms of which are described [*cf. R.A.E.*, A **31** 227] occurs over large areas in eastern England and had a serious effect on the crop there in 1943 and 1944. If the leaves turn yellow early, in July or August, the plants are stunted and yields considerably reduced, but if they do not do so until late, in September or October, the yield is little affected. The earliness of infection depends largely on the behaviour of the aphid vectors; in mild winters, viviparae of *Myzus persicae*, Sulz., survive and reproduce on crucifers or overwintering seed crops of beet and mangel, and large populations develop on the seed crops during May, so that infective migrants are ready to enter the root crops early in June. The root crops are usually only lightly infested by this Aphid, however, and the virus does not become widely spread until populations of *Aphis fabae*, Scop., which overwinters only in the egg stage, on spindle [*Euonymus*], develop towards the end of July. In severe winters *M. persicae* also survives only in the egg stage, on peach, and since neither of these winter food-plants is susceptible to the virus, and the disease is not carried in the egg, it is some time before Aphids from them can infect the root crop [*cf.* **31** 228]; usually it is too late for *M. persicae* to infest the root crop at all, and the virus is introduced and spread by *A. fabae*, infection being fairly common but late if infestation is heavy, and negligible if it is light. Serious and widespread outbreaks of the disease probably occur only after a succession of mild winters; after one such winter, early infection is confined chiefly to the seed-crop areas near the main sources of infection, but if the following winter is mild, some plants of the heavily infested root crop remaining in the ground and also infected mangels, spinach and spinach-beet survive and provide widespread sources of infection in the following year.

Separating the beet and mangel seed crops from the root crops would reduce the severe and frequent outbreaks of the disease that now occur in the latter in the seed areas, but would probably not eliminate them, because of other sources of infection and the long distances travelled by migrating Aphids, and it is considered more desirable to produce seed crops free from disease and Aphids than to isolate them. Fumigation of the seed crop is unsatisfactory, as infected migrants are leaving it by the time the necessity for fumigation becomes apparent, and it seems likely that removing the beds in which the stecklings for the seed crops are raised, which are infected by Aphids from infected root and seed crops in August and September, to areas that are relatively free from Aphids and importing the stecklings into the seed areas for setting out in spring is the method most likely to produce healthy crops. If the steckling beds are in the seed-growing areas, they should be as far as possible from the root and seed crops, and should be sown late if the root crop is seen to be infected in July; stecklings showing infection in autumn should be pulled up, and heavily infected beds should be ploughed under. Spraying or fumigation to destroy the Aphids must be repeated frequently if it is to be effective; experiments have shown that repeated spraying greatly reduces infection, although it does not eliminate it. Root crops should be grown as far as possible from seed

crops. As in the case of the seed crop, fumigation is usually unsuccessful. When there is early spread of the virus by *M. persicae*, early-sown crops are infected more seriously than later ones, but when most of the spread is caused by *A. fabae* in July, late-sown crops suffer most. Early sowing is preferable, because in most years the crops tend to be less infected, and even if they do become infected, a smaller proportion of the yield is lost. Away from a seed area and in conditions of moderate virus infection, a particularly vigorous crop may be infected less or later than others, but this does not seem to be the case when the disease is prevalent. In experiments, both the absolute loss and the percentage loss of yield caused by infection were greater on manured plots than on untreated ones, but a well-grown crop may give a reasonable yield in spite of infection, whereas a badly grown crop may be destroyed completely. No variety of sugar-beet has proved consistently less susceptible to the infection than others, but small differences indicate that the breeding of resistant or tolerant varieties may be possible.

BRYDEN (J. W.) & BISHOP (M. W. H.) *Perilitus coccinellae* (**Schrank**) (**Hym., Braconidae**) **in Cambridgeshire.**—*Ent. mon. Mag.* **81** no. 970 pp. 51–52, 3 refs. London, 1945.

Adults of *Perilitus coccinellae*, Schr., were reared from seven adults of *Coccinella septempunctata*, L., collected in Cambridgeshire in July–August, 1944. One survived for ten days in the laboratory and apparently oviposited in 19 adults of *C. septempunctata*, five of *Adalia bipunctata*, L., two of *Thea viginti-duopunctata*, L., and one of *Propylea quatuordecimpunctata*, L., but parasites were reared only from the first species. The process of oviposition and the development of the larvae in the beetles are described. The parasite larvae emerged from their hosts, one from each, 22–38 days after oviposition. They constructed cocoons between the legs of the host, and adults emerged 14–17 days later. All the parasites reared from field-collected material or in the laboratory were females. The hosts become lethargic before the emergence of the larva, after which the muscles of their legs contract, so that the latter envelop the cocoon. If the cocoons are removed and the hosts fed, they gradually recover the use of their legs; some survived for several weeks after parasites had emerged from them and one appeared to have recovered completely after four weeks. Records of the parasite from various districts in south-eastern England in 1925–43 are given in a footnote by K. G. Blair; the hosts were *C. septempunctata* and *C. undecimpunctata*, L.

MORETON (B. D.). **On the Migration of Flea Beetles** (*Phyllotreta* **spp.**) (**Col., Chrysomelidae**) **attacking** *Brassica* **Crops.**—*Ent. mon. Mag.* **81** no. 970 pp. 59–60. London, 1945.

The activity of adults of *Phyllotreta* spp. was studied in the spring and early summer of 1944 in a field in Sussex in which four parallel strips were sown successively between late March and early July with three crops of kale and one of swedes, and which had not borne cruciferous crops for three years previously. The species present were *P. cruciferae*, Goeze, and *P. consobrina*, Curt., which together made up 47 per cent. of the population, *P. undulata*, Kutsch. (30 per cent.), *P. nigripes*, F. (7 per cent.), and *P. nemorum*, L., *P. vittula*, Redt., *P. diademata*, Foudr., and *P. atra*, F. The beetles were inactive on dull days and also on sunny ones until the temperature at soil level in sunshine reached 70°F. They flew freely in a light breeze and at heights up to nine feet above the ground and over sites remote from the food-plants, but flew only within six inches of the ground and for distances of not more than a yard if the wind was stronger, and remained on the plants during a moderate gale. The maximum height at which they fly is probably determined by the level

at which the surface air current exceeds a light breeze. Their distribution in the field was mapped daily by counts at random points. Five sudden increases in population were observed in April-May, coinciding with periods of sunny weather with light wind. At the beginning of the season, the beetles were most numerous along an edge of the field that was adjacent to a wood, in which they had probably overwintered. Migration to newly-germinated crops was negligible in dull weather and slow in sunny, windy weather; most of the beetles did not penetrate beyond the headlands for a week or fortnight, and infestation spread most rapidly along the sheltered headlands. During hot, still weather in May, when populations were highest, whole crops became infested in 1–2 days; it is probably under such circumstances that germinating seedlings are destroyed before the cotyledons appear above the ground. Migration appeared to be by random dispersal.

The beetles took to flight during the application of dusts to the plants and when the soil dust was disturbed by hoeing; on one occasion when dusts were being applied from the windward side of the field, the beetles were driven across and ultimately out of it. This habit and the influence of weather on flight may account for the divergent results obtained with dusts by growers, since, if a field is cleared of beetles by a dust that is not toxic for a long period, the likelihood of reinfestation depends on the extent to which the subsequent weather favours migration.

BENSON (R. B.). *Urocerus californicus* **(Norton) and some other interesting Siricidae (Hym., Symphyta) in Britain.**—*Ent. mon. Mag.* **81** no. 970 pp. 67–68, 4 refs. London, 1945.

The author records the finding in Britain of a living female and two living larvae of *Urocerus californicus*, Nort., in timber of *Abies nobilis* that had been stored in England for some time after its importation. Both the tree and the Siricid occur in British Columbia and the western United States. The distribution of the latter and a list of the conifers infested by it are given from the literature.

Further evidence of the occurrence of *Sirex juvencus*, L., in North America [*cf. R.A.E.*, A **31** 350] was obtained in 1943, when two males and two females were reared from spruce recently imported from Canada. The basal segments of the antennae of one of the males showed the red coloration typical of European males of this species, but those of the other were black, and its identity is therefore in doubt, as no characters are known distinguishing males of *S. juvencus* with black antennae from males of *S. cyaneus*, F. The antennae of both females were black [*cf. loc. cit.*].

A female of *U. gigas taiganus*, Benson [*loc. cit.*] was taken in Hertfordshire in June 1942, but the timber from which it emerged is unknown.

SANKEY (J. H. P.). **Observations on** *Pentatoma rufipes* **L. (Hem., Pentatomidae) on Cherry Trees.**—*Ent. mon. Mag.* **81** no. 971 pp. 86–87. London, 1945.

Many adults and a few fifth-instar nymphs of *Pentatoma rufipes*, L., occurred in early July 1943 on cherry trees in three orchards in Kent. Some of the fruits had been damaged by their punctures, which resulted in crinkling of the skin and malformation, and though there was little tainting of the fruit, the pickers were disturbed by the odour of the bugs. At the middle of the month, the bugs became more numerous and a few were observed on apple and plum. At the end of September, most of the adults had disappeared, and second-instar nymphs were numerous on the trees; an adult of *Himacerus* (*Nabis*) *lativentris*, Boh., was observed feeding on one of them. As the nymphs appeared to be preparing for hibernation on the lower parts of the trees or in

the ground, adhesive bands were applied to the trunks at a height of about 4 ft. in early October. The bands were examined in early February, after the trees had been sprayed with tar oil, and many nymphs were found on them. At the beginning of May, there were still more on the bands, some crawling up the trunks below them and some still hibernating under loose bark. None was found at any time above the bands or in the turf below the trees, although many samples of the latter were examined.

Plantesygdomme i Danmark 1944. Plant Diseases and Pests in Denmark 1944. —*Tidsskr. Planteavl* **50** pp. 1–76, 4 figs.; also as *Aarsovers. Plantepat. Forsøg* no. 61. Copenhagen, 1945. (With a Summary in English.)

This report contains a section (pp. 44–66) in which P. Bovien surveys the principal pests of cultivated plants in Denmark in 1944 as in previous years [*cf. R.A.E.*, A **33** 381]. Insects that caused unusually severe damage included *Trioza apicalis*, Först., on carrot, *Pegomyia hyoscyami*, Panz., on beet [*cf.* **34** 8], *Tipula paludosa*, Mg., on numerous field crops, including wheat, beet, hemp, flax and tobacco, larvae of *Anomala* (*Phyllopertha*) *horticola*, L., on rye, *Jaapiella medicaginis*, Rübs., on lucerne, *Eriosoma* (*Schizoneura*) *lanigerum*, Hsm., on apple, and *Nematus* (*Pteronus*) *ribesii*, Scop., on gooseberry. Fruit trees were injured by *Paratetranychus pilosus*, C. & F., and fruit and other deciduous trees on a small island to the south-east of Zealand by *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, auct.). Tobacco leaves hung in a shed for drying were damaged by *Forficula auricularia*, L.

Larsson (S. G.). **Husbukken** *Hylotrupes bajulus* **L.**—*Smaaskr. Zool. Mus. København* no. 1 [23] pp., 9 figs. Copenhagen, 1945.

A popular account is given of the bionomics of *Hylotrupes bajulus*, L., which is an important pest of structural timbers in Denmark [*cf. R.A.E.*, A **19** 379, 740] and of the conditions that favour its development in attics and roofs, together with very brief notes on its control [*cf.* **20** 456; **21** 214]. Injury by this Cerambycid in buildings has become of increased importance in recent years, since the size of the beams, etc., used in construction is now more closely related to the strains involved than was previously the case, so that they are liable to break after a smaller amount of damage.

Fisher (R. C.). **Chemical Preservation of Timber. The Control of Wood-boring Insects.**—*Chem. Age* 1945 repr. 6 pp., 4 figs., 19 refs. London, 1945.

The author gives a brief outline of some of the problems involved in the treatment of structural timber and furniture to prevent infestation by wood-boring insects, and reviews from the literature recent developments in the use of chemicals for the prevention and control of such infestation. The insects dealt with are pinhole borers (Platypodids and Scolytids), powder-post beetles (Bostrychids and Lyctids), furniture beetles (*Anobium punctatum*, Deg., and *Xestobium rufovillosum*, Deg.) and termites.

Tseng (Sheng). **A comparative Study on the Morphology of Cutworms, Part I, External Morphology.**—pp. 41–56, 6 pls., 11 refs. [*Sine loco*, ? 1943.]

Details are given of the external morphology of the larvae of *Agrotis tokionis*, Btlr., *A. ypsilon*, Hfn., *Amathes* (*Agrotis*) *c-nigrum*, L., and *Euxoa messoria*, Harr., which are the four cutworms known to be injurious in China, with special attention to characters by which the species can be distinguished.

DAS (G. M.). **Studies on the Jute Stem-weevil *Apion corchori* Marshall. I, Bionomics and Life-history.**—*Indian J. agric. Sci.* **14** pt. 4 pp. 295–303, 1 pl., 4 figs., 12 refs. Delhi, 1945.

An account is given of the bionomics of *Apion corchori*, Mshl., and of the injury that it causes to jute (*Corchorus olitorius* and *C. capsularis*) [*cf. R.A.E.*, A **29** 446], of which the author considers it to be a major pest. It is common in Assam, Bihar, Orissa, and all the jute-growing districts of Bengal and has been recorded in Madras. In the laboratory, the preoviposition period lasted 3–9 days, the females laid up to 675 eggs over periods that ranged up to 124 days, and one adult survived for 209 days. Oviposition was reduced towards the end of the jute season and practically ceased by December. In June–July at temperatures averaging about 85°F., the egg and pupal stages lasted about 3 and 4 days, and the duration of the larval stage varied from 8 to 18 days, according to the condition of the stems. In January, at 71·9°, the egg stage lasted about 5 days.

There is much overlapping of generations in the field, and the weevils were observed to attack self-sown plants as early as January and seedlings 2 ins. high by the middle of March. Of the wild species of jute, *C. acutangulus* was found to be very susceptible to attack, and *C. trilocularis* and *C. fascicularis* less so, and of the cultivated species, *C. olitorius* was less heavily infested than *C. capsularis*, possibly because it contains more tannin. Infestation was lower in the middle of a field than at the edge, and decreased as the distance from hibernation quarters increased. Manuring with superphosphates and lime or with superphosphates, ammonium sulphate and potash reduced attack, whereas nitrogenous manures increased it. More than 50 per cent. of the larvae were attacked by a Braconid ectoparasite or a Miscogasterid endoparasite [*cf.* **29** 447]. Suggested control measures comprise destroying the immature stages by burning or retting the infested plants, detected by their withered tops, during the early part of the crop season, and submerging in water plants removed during thinning; destroying infested self-sown plants by ploughing or harrowing; collecting and burning or submerging stubble immediately after harvest and ploughing the fields soon after harvest; and stacking the harvested jute for not more than four days before steeping, since more parasites than weevils emerge from it during the first five days after cutting, but more weevils than parasites later.

RAHMAN (K. A.). **Biology and Control of Maize and Jowar Borer (*Chilo zonellus* Swin.).**—*Indian J. agric. Sci.* **14** pt. 4 pp. 303–307, 7 refs. Delhi, 1945.

The results are given of investigations carried out for a number of years in the Punjab on *Chilo zonellus*, Swinh., which is the most destructive pest of maize and sorghum in India and is particularly injurious in that province. The moths were active at night and laid their eggs on the leaves in clusters of 10–36 from the end of March until the end of October; most eggs were deposited in April and August and fewest in May, June and October. The egg-stage lasted 2 days in April, 3–4 days in May-September and 5 days in October, and the larval and pupal stages lasted 15–31 and 2–9 days, respectively, during April-September. There were 6–7 overlapping generations in the year. Hibernation occurred in the larval stage and lasted from the second week of October to the end of March; in maize, 76·7 per cent. of the larvae hibernated in the stubble, 13·5 per cent. in stems and 9·8 per cent. in cobs, whereas in sorghum, 12·2 per cent. hibernated in stubble and 87·8 per cent. in stems. The pupal stage of overwintered larvae lasted 7–15 days, and, in the laboratory, the adults emerged from maize or sorghum stubble from the first week of April until the third week of June and from maize cobs from the third week of April until the end of June.

C. zonellus damages grain crops more than fodder crops. It attacks all parts of the maize plant except the root, and the stems of sorghum. The application of nitrogenous manures to stimulate plant growth and encourage earlier node formation had no effect on the incidence of attack in maize. When maize was sown at fortnightly intervals from the middle of July, examination 1–2 months later showed that the crop sown in July was more severely attacked than that sown on or after 7th August.

RAHMAN (K. A.) & ANSHI LAL BATRA. **The Onion Thrips (*Thrips tabaci* Lind. : Thripidae : Terebrantia : Thysanoptera).**—*Indian J. agric. Sci.* **14** pt. 4 pp. 308–310, 8 refs. Delhi, 1945.

Thrips tabaci, Lind., was found in the Punjab for the first time in 1930, on onion and garlic, and investigations on its bionomics and control on onion were begun at Lyallpur in 1939. No males were found. The females laid 50–60 eggs at the rate of 4–6 per day, singly in the leaf tissue on the underside of the leaf, and the eggs hatched in 8–9 days in January-February and 7, 6, 5 and 4 days in March, April, May and June, respectively. The nymphal stage lasted 6 days in January-March and 4–5 days in April-June, the prepupal stage 1–2 days, and the pupal stage 4 days in January-March, 3 days in April and 2 days in May-June. The prepupal and pupal stages were passed in the soil at a depth of 1–2 ins. The thrips appeared during the last week of November on onion plants grown from sets and migrated in spring to those grown from seed, which are transplanted in January-February. Large numbers of eggs were then laid, and all stages were found in the fields from about the beginning of March to the end of May. The population was greatest in April and the first week of May, and the greatest damage to plants grown from seed occurred during this period. In June, when the onions were harvested, the thrips migrated to other plants, a list of which is given.

The thrips was most injurious during dry seasons, when it destroyed 75 per cent. of the crop. Of various sprays tested against it, the most effective was 1 oz. nicotine sulphate and 8 oz. fish-oil soap in 6 gals. water, which gave 82 per cent. mortality. Dusts, including 3 per cent. nicotine, gave very low mortalities.

LIU (Chi-ying) & YEN (Chia-hsien). **Studies on the Control of the Yellow-striped Flea Beetle (*Phyllotreta vittata* Fabricius) Part I. Mechanical Devices for controlling the Adult Stage by means of sticky Material.** [*In Chinese.*]—*Kwangsi Agric.* **2** no. 3 pp. 189–204, 6 figs., 25 refs. [Liuchow] 1941. (With a Summary in English.)

Phyllotreta vittata, F., is a major pest of crucifers, especially seedlings and young plants, in Kwangsi, where outbreaks are common in spring and autumn. Tests of adhesives for use on devices for catching the beetles were begun in 1938 ; those used were mixtures of 2 parts tea-seed oil and 3, 4 or 5 parts pine resin. There was no significant difference between the percentages of beetles trapped by the mixtures containing the higher proportions of resin, but the other was significantly less effective. The adhesives were most effective 8–10 days after preparation, and retained their efficacy for 16 days when stored under room conditions in October and November.

Two trapping devices were tested in 1939 and 1940, and one, used in seed-beds, reduced the number of beetles significantly. It consists of a board of adjustable height set on wheels ; its under side is smeared with the adhesive and has brushes along the middle and the hind edge to disturb the beetles as it passes over the seedlings. The other device consists of a box, open at the ends and, except for side flanges projecting inwards, at the bottom, which is passed by hand over individual plants in the field. It has the inside coated with the adhesive and the beetles are disturbed by cords hanging from the top. It gave

good results in preliminary work, but was subsequently not entirely satisfactory in a large-scale campaign, because it was difficult to adjust to plants of different heights and the cords did not disturb the beetles enough. It is therefore suggested that it would be improved by fitting it with an inner top, the height of which can be adjusted to that of the plants, and by attaching brushes to the rear end to supplement the effect of the cords.

YEN (Chia-hsien), LIU (Chi-ying) & KUO (Kuang). **A preliminary Study on the Life-history of the Rice Stem Midge, *Pachydiplosis oryzae* Wood-Mason (Cecidomyiidae, Diptera) in Kwangsi Province, South China.** [*In Chinese.*]—*Kwangsi Agric.* **2** no. 6 pp. 429–453, 10 figs., 22 refs. [Liuchow, 1941.] (With a Summary in English.)

Investigations on the bionomics of the rice stem midge, *Pachydiplosis oryzae*, Wood-Mason, all stages of which are described, were made in Kwangsi in 1938–39. Sporadic outbreaks of this Cecidomyiid occur in several provinces of South China, and considerable damage is caused to rice plants in all stages of growth. In Kwangsi, there were five generations a year, and the winter was passed in the larval stage within rice stubble. Adults were first observed in flight in late March, and were most numerous in early August, when mid-season varieties are heavily attacked. As each variety approached maturity, attack was transferred to the succeeding one. The egg, larval and pupal stages, lasted 3–4, 14–28 and 4–5 days, respectively, between July and October. The numbers of eggs deposited by individual females averaged 131 and ranged up to 285. The adults survived for 1–3 days and are active by night. Males comprised about 70–90 per cent. of the adults taken at light between April and June, and females nearly all those taken from July to November, and similar ratios were observed among adults collected in the field. Females taken at light contained significantly fewer eggs than those taken in the field. The eggs were laid singly or in groups on the leaves ; 62 per cent. were deposited on the leaf-blades and the rest on the leaf-sheaths of plants in seed-beds, and 79 per cent. on the leaf-blades, 16 per cent. on the leaf-sheaths and 5 per cent. on the rolled heart leaves in the fields. Eggs were also found on the leaves of *Paspalum orbiculare*, *Panicum repens* and *Zizania latifolia*. The percentages that hatched varied from 77 to 98. Newly-hatched larvae survived immersion in water for 2–5 days, and appear to require a considerable amount of moisture. In August 1938, 47 per cent. of the seedlings in submerged beds were infested, whereas no damage was noted in beds that were irrigated from ditches surrounding them. Infested seedlings and plants are characterised by the development of a hollow tubular gall in place of the normal culm [*cf. R.A.E.*, A **11** 256], which becomes thickened and swollen and produces no grain. The young shoots that develop after harvest may also be infested and have a tubular appearance. The larvae have usually pupated by the time the gall becomes noticeable, and the pupae were able to move up the tubes for a distance of about 5 ins. and downwards for about 2½ ins.

In experiments in 1938 and 1939, 15–16 per cent. of infested seedlings that were transplanted eventually died, and the yield of those that survived was reduced.

CHEO (Ming-tsang) & LING (Yu). **Life History Studies on the Cruciferous Leaf-beetle (*Phaedon brassicae* Baly, Coleoptera).** [*In Chinese.*]—*New agric. J.* **3** no. 1–2 pp. 50–61 ; also as *Tech. Bull. Fukien prov. Coll. Agric.* no. 16, 12 pp. Yungan, Fukien, 1943. (With a Summary in English.)

Observations were made at Hangchow in 1935 on the bionomics of *Phaedon brassicae*, Baly, the larvae and adults of which skeletonise the leaves of crucifers and which is the most widely distributed and injurious pest of cruciferous

vegetables in China. Five generations were reared during the year in the insectary, but only three occur in the field, as the adults aestivate in summer when high temperatures and lack of food render conditions unfavourable. During this period and also during the winter, they shelter in loose soil, under crop débris, among weeds, and in other situations protected from direct sunlight and rain. They are most active by day, when they occur on the lower surface of the leaves ; they do not fly, but disperse by crawling on the ground. Mating takes place 4–11 days after emergence, and the females begin to oviposit 1–5 days later. The eggs are laid singly in slight cavities gnawed in the lower surface of the leaves and petioles. The females deposited 220–473 eggs in 13–19 days, and the adults survived for 23–37 days under insectary conditions. Eggs of the first and second generations hatched in 10–27 and 6–9 days, respectively, the duration of the larval stage ranged from 11–28 days in the first generation to 6–8 days in the third and fourth, and that of the pupal stage, which is passed in a cell constructed in loose soil, from a minimum of three days to a maximum of 14.

P. brassicae can be effectively controlled by sprays and dusts prepared from *Tripterygium wilfordi* [*cf. R.A.E.*, A **25** 231 ; **29** 241, etc.], and other measures that appear promising are crop rotation, the use of uninfested seedlings, preventing the beetles from crawling into a field by surrounding it with a ditch filled with water, and jarring the larvae and adults from the plants on to a shallow pan smeared with an adhesive.

CHEO (Ming-tsang). **Experiments on the Resistance of the Chicken-foot Cotton** (*Gossypium arboreum*, **L. var.** *neglecta* & *G. arboreum*, **L. var.** *rosea*) **to the Cotton Leafroller** (*Sylepta derogata* **Fab., Lepidoptera**). [*In Chinese.*]—*New agric. J.* **3** no. 1–2 pp. 62–69 ; also as *Tech. Bull. Fukien prov. Coll. Agric.* no. 17, 8 pp. Yungan, Fukien, 1943. (With a Summary in English.)

Investigations were carried out at Hangchow in 1935–38 to determine whether differences in the size and shape of cotton leaves, which are very variable, are correlated with resistance to *Sylepta derogata*, F., which is one of the most injurious cotton pests in China. The comparison was between a number of varieties having relatively undivided leaves and two varieties of *Gossypium arboreum* (*neglecta* and *rosea*), in which the leaves are divided into 5–7 narrow, oblong, lanceolate lobes. In insectary experiments with 20 cages, each containing two pairs of newly-emerged adults of *S. derogata* and two plants, one with divided and the other with undivided leaves, the average number of larvae per plant after 20 days was significantly lower on each of the varieties with divided leaves than on the variety with which it was compared. In another experiment in which ten potted seedlings of each of the varieties with divided leaves and of six of those with undivided leaves were arranged in randomised blocks in a large outdoor screen cage in the centre of which 25 pairs of newly-emerged moths were liberated, there were fewer rolled leaves on the divided-leaved varieties than on the others when the plants were examined 20 days later, and in most cases the difference was statistically significant. In a field experiment, using *G. a. neglecta* and seven varieties with undivided leaves in randomised blocks, the percentage of plants on which 50 per cent. or more of the leaves were rolled by the larvae was only 9·05 on the former and over 95 on the latter varieties. No significant differences in infestation were found among the varieties with undivided leaves.

CHEO (Ming-tsang) & CHANG (Yun-hwa). **Studies on the Rice Weevil** (*Calandra oryzae* **L., Coleoptera**) **Control.** [*In Chinese.*]—*New agric. J.* **3** no. 3–4 pp. 178–217, 7 refs. ; also as *Tech. Bull. Fukien prov. Coll. Agric.* no. 23, 39 pp. Yungan, Fukien, 1943. (With a Summary in English.)

Calandra oryzae, L., shows a marked preference for rough rice or wheat as compared with rice in the husk, which is rarely infested, flour or bran ; where

possible, therefore, rice should be stored in the husk and wheat should be ground and stored as flour. When infested rice in layers 3, 5 and 7 cm. thick was exposed to the sun for 3½ hours, during which its temperature rose to 45°C. [113°F.], most of the weevils were killed and some escaped; only dead weevils were found in the thinnest layer, and only 0·2 per cent. of those in each of the other two layers were alive. The percentages of weevils able to make their way into bags of linen, newspaper and tough paper containing rice or wheat were 82·3, 14·5 and 4·3, respectively. Mixing the seeds with hydrated lime or sand did not prevent infestation, and had little or no effect on the reproduction and development of the weevils, but covering stored rice with a layer of sand 2–4 cm. thick prevented weevils from entering it, while those already present made their way into the sand, where they eventually starved. This movement into the sand is explained by the normal habit of the weevils of moving up and down in stored rice; it is largely prevented if a sheet of paper is placed between the rice and sand to keep the former clean, though the sand layer still prevents infestation from outside. Fine sand was more effective than coarse, but not than sand containing both fine and coarse particles.

YEN (Chia-hsien). **Studies on the Life History of the Sugar-cane Borer, *Argyria* sp., with special Reference to the Damage caused by the Borer to the Cane.** [*In Chinese.*]—*New agric. J.* **3** no. 3–4 pp. 97–112, 1 pl., 1 fig., 7 refs.; also as *Tech. Bull. Fukien prov. Coll. Agric.* no. 18, 15 pp. Yungan, Fukien, 1943. (With a Summary in English.)

The results are given of preliminary observations in Kwangsi in 1938 on the bionomics of a sugar-cane borer of the genus *Argyria*, and all stages are described. There are five generations a year, and the larvae overwinter within the cane slips and stubble. The adults, which are active by night, were first observed in flight in early April. They survived for 1–13 days, with an average of about a week, and paired on the first night after emergence, oviposition beginning shortly afterwards. Over 95 per cent. of the eggs deposited hatched. The larval stage lasted 3–4 months in overwintering larvae and 17–75 days in others, and the pupal stage, which is passed in the gallery of the larva, usually occupied 5–10 days. The young larvae eat across the folded youngest leaf of the cane and then mine downwards through the leaf blade, causing the central shoot in young canes to die. Injured canes may be replaced by fresh ones, but their growth is noticeably checked, and they do not all reach maturity at the same time. Infested canes were found to be shorter and lighter than uninfested ones, and the difference in height, but not in weight, was statistically significant. In older canes, in which damage is more serious than in young ones and in which secondary attack by a fungus occurs, the tissues become reddish in colour, the juice is sour, and the yield of sugar is reduced.

WILSON (F.). **The Restriction of Insect Infestation to the Periphery of Bulk Wheat.**—*J. Coun. sci. industr. Res. Aust.* **18** no. 1 pp. 1–5. Melbourne, 1945.

Appreciable damage by insects in the mounds of wheat that have been kept in bulk storage in bins or large sheds in Western Australia and Victoria during the war years has been restricted to the periphery of the mound [*cf. R.A.E.*, A **32** 139; **33** 319], that is, to a thin layer at the surface, the walls and, occasionally, the floor. In this paper an account is given of the factors responsible for this restriction; the data on which the conclusions are based are to be published later.

If infestation occurs in the middle of a mass of wheat, it causes the temperature there to increase until it is near the maximum at which the insects can breed. The rise in temperature increases the vapour pressure and decreases the relative humidity of the inter-granular air, as a result of which moisture passes into the surrounding, uninfested and cooler wheat. Gradients of temperature

and moisture content are thus set up, the former falling and the latter rising towards the periphery, and the centre becomes too dry for infestation at the temperature prevailing. As this occurs, the insects migrate into the surrounding wheat, which in turn gradually becomes unfavourable. A gradient of insect density is thus set up round a central lethal zone ; the temperature of this zone is maintained at a high level by the equal temperature round it and it gradually increases in size.

The wheat at the surface of a mound is influenced by atmospheric conditions, but the effect of an annual fluctuation in moisture content of 5 per cent. at the surface becomes negligible at a depth of 2–3 ft., and that of an annual fluctuation in temperature of about 55°C. [99°F.] is reduced to one of 18°C. [32·4°F.] at a depth of one foot and to 4°C. [7·2°F.] at one of nine feet [*cf.* **33** 318]. The maximum temperature reached owing to infestation by wheat stored in bulk is 42°C. [107·6°F.] and, since the mean daily temperature of the air in the depots is lower than this and the temperature of the wheat at the surface is little influenced by that of the lower layers, a sharp temperature gradient is maintained to a depth of about one foot. As infestation enters this layer, the great loss of heat from it permits high insect populations to develop, since the temperature is not excessive for the existing moisture content. Additional factors permitting the development of high populations are the higher moisture content maintained by the presence of relatively cool wheat at the surface, and the liberation of moisture by the activities of the insects ; some evidence of the movement of moisture from the lower levels by convection currents was also obtained. This high humidity enables breeding to take place at higher temperatures than would be possible under dry conditions. Most heat and least moisture is lost from the surface of the mounds in winter, so that insect densities in well-established infestations must be higher then than in summer.

The same factors operate in grain against the retaining walls and floors, but with different intensity. Wooden walls provide some insulation, which limits infestation, but corrugated iron permits the development of dense populations since it has no insulating effect and the condensation of moisture on its surface enables breeding to continue at high temperatures. Infestation is generally of little importance near the floor, especially if this is of sheet iron or concrete, as the heat passes relatively slowly through it to the soil beneath, but where it is of bitumen, the moisture content is often considerably increased and infestation is then heavier. Infestation most frequently begins at the surface of a mound, as this is where insect dispersal occurs most readily and where the temperature and moisture content of the wheat, which are low when it is placed in storage, can be raised by atmospheric conditions. Although infestation can penetrate a considerable distance into the mound, physical conditions there prevent insect breeding before much damage has occurred.

The moisture content of wheat recently placed in storage has generally been not higher than 10 per cent. If the wheat contained 12–13 per cent. moisture, the insects could breed at higher temperatures and cause somewhat more damage before they became restricted to the periphery of the mound, the temperature gradient and consequently the infestation would extend through a greater depth of wheat, the relative importance of the species involved would change [*cf.* **30** 278], and fumigation of the surface would be unlikely to control the numerous outbreaks. Damage could be minimized, however, by taking measures to reduce the loss of heat from the mound.

Birch (L. C.). **The Influence of Temperature on the Development of the different Stages of** *Calandra oryzae* **L. and** *Rhizopertha dominica* **Fab. (Coleoptera).**—*Aust. J. exp. Biol. med. Sci.* **23** pt. 1 pp. 29–35, 3 figs., 7 refs. Adelaide, 1945.

The following is largely the author's summary of laboratory investigations in Adelaide in which *Calandra oryzae*, L., and *Rhizopertha dominica*, F., were

reared in wheat of 14 per cent. moisture content. The range of temperatures that permitted complete development from egg to adult was 15·2–34°C. [59·36–93·2°F.] for *Calandra* and 18·2–39°C. [64·76–102·2°F.] for *Rhizopertha*. Most of the mortality at unfavourable temperatures occurred among the eggs and first-instar larvae of *C. oryzae* and among first-instar larvae of *R. dominica*. Development from egg to adult took place most rapidly at 29·1°C. [84·38°F.] in *C. oryzae* and at 34°C. in *R. dominica*, but in both species the temperature required by the eggs for most rapid development was higher than that required by the larvae. There was no significant difference in the rate of development of the two sexes. The range of temperatures within which mortality was low and beyond which it increased significantly was 18·2–32·3°C. [64·76–90·14°F.] for *C. oryzae* and 26·0–36°C. [78·8–96·8°F.] for *R. dominica*. All stages of *R. dominica* took longer to develop than those of *C. oryzae* at any temperature except 32·3°C., at which both species required about the same time to complete development from egg to adult. *C. oryzae* developed more slowly when three individuals were present in a single grain than when there was only one. The development of both species was retarded in wheat with a moisture content of less than 14 per cent.

BIRCH (L. C.) & SNOWBALL (J. G.). **The Development of the Eggs of *Rhizopertha dominica* Fab. (Coleoptera) at constant Temperatures.**—*Aust. J. exp. Biol. med. Sci.* **23** pt. 1 pp. 37–40, 1 fig., 1 ref. Adelaide, 1945.

The durations of the egg stage of *Rhizopertha dominica*, F., at two levels of humidity and eight constant temperatures between 18·1 and 38·3°C. [64·58 and 100·94°F.] were investigated to determine the validity of the assumption that the influence of moisture is the same at different temperatures provided that the product of saturation deficit and the duration of development remains constant [*R.A.E.*, A **34** 22]. In a preliminary experiment, survival was found to be highest when the values for this product (with the factors expressed in inches and days) lay between 1 and 3·5, and the approximately constant values of 2·68 and 1·4 were selected for the investigation. The relative humidities corresponding to the two moisture levels at each of the eight temperatures were calculated from an approximate estimate of the duration of the egg stage at a relative humidity of 90 per cent. for temperatures of 18·1, 22 and 34·1°C. [64·58, 71·6 and 93·38°F.] and 73 per cent. for the rest. They were 88 and 94 per cent. at 18·1°C. and 73 and 86 per cent. at 38·3°C. The development period was significantly shorter at the higher moisture level at all temperatures except 18·1, 22 and 32°C. [89·6°F.], and development was most rapid at both levels at 36°C. [96·8°F.]

The results show that the index provided by the product of saturation deficit and duration of development is not completely independent of the influence of temperature, but it is probably the most reliable one available for maintaining constant moisture conditions over a range of temperatures. Logistic curves were fitted to the curves obtained by plotting the mean reciprocal of the development period against temperature, and the goodness of fit was tested, both by methods already described [*loc. cit.*]; the trend of the plotted curves was accurately described by logistic curves of the formulae given.

ANDREWARTHA (H. G.). **The Distribution of Plagues of *Austroicetes cruciata* Sauss. (Acrididae) in Australia in Relation to Climate, Vegetation and Soil.**—*Trans. roy. Soc. S. Aust.* **68** pt. 2 pp. 315–326, 2 pls., 4 figs., 21 refs. Adelaide, 1944.

Outbreaks of *Austroicetes cruciata*, Sauss., occur in well-defined areas on the borders of the wheat belts of Western and South Australia and New South

Wales ; the areas in Western and South Australia are separated by an extensive region in which the species does not occur, and those in South Australia and New South Wales by one in which solitary individuals occur but swarms rarely develop. The distribution of these outbreak areas is restricted primarily by climate. In all three States, spring temperatures favourable for the development of the active stages and winter temperatures favourable for the elimination of the diapause in the eggs occur over a much wider area than that actually infested, the limits of which are determined by the moisture requirements of the species, since sufficient rain must fall in winter and spring to keep the food-plants green until oviposition begins.

When the infestation areas for South Australia were plotted on a map with isopleths for various values of the monthly rainfall-evaporation ratio, P/E [*cf. R.A.E.*, A **28** 593], it was found that the boundary on the drier side coincided well with the isopleth for P/E=0·25 for October. The infested areas in the other States also fall mostly within an area bounded on its drier side by this isopleth, plotted for October in New South Wales and for September in Western Australia, where *A. cruciata* appears about a month earlier. The humid areas near the coast are not infested, probably because conditions there favour the development of fungus and bacterial diseases of the nymphs [*cf.* **18** 624]. Thus, swarms that had developed from solitary individuals in 1936 and 1937, when humidity in July and August was not excessive, over an area in Western Australia that is not usually infested, disappeared in 1938, when rainfall in July was unusually heavy. As the egg stage has been shown by the author to be little affected by high humidity, the amount of rainfall during May and June does not directly influence survival ; it may produce an indirect effect, however, by promoting dense herbage and so increasing the humidity near the surface of the soil, where the grasshoppers occur. The limits of the infested area on the humid side were found for the most part to correspond with the isopleth for P/E=1·0 for September in South Australia and New South Wales and for August in Western Australia ; the significance of this P/E ratio depends on the amount of correlation between it and the frequency and intensity of periods of humidity high enough to favour fungi and bacteria. An isopleth for a single month can be utilised for the areas under consideration because humidity is highest in them early in the season when the nymphs are in the early stages of development. Isopleths for P/E ratio=1 for September and 0·25 for October extend northwards into southern Queensland, but have little significance in indicating the limits of zones favourable for *A. cruciata* at latitudes north of about 31°S, where most rain falls in the summer and swarms do not occur.

The distribution of outbreak areas within the zone in which climate is favourable is determined by the occurrence of firm compact soil suitable for oviposition and of favourable food-plants. The distribution of soil types has not been mapped in detail, but that of the original undisturbed vegetation types, which is better known, is related to it and may be used to indicate soils favourable to *A. cruciata*. Woodland soils, which are mostly sandy loams, often shallow, and with increasing amounts of clay in the lower layers, provide ideal conditions for oviposition if they have been cultivated and have then been allowed to consolidate for a few years. The shrubby undergrowth of the native woodland associations does not provide a suitable habitat, since the preferred food-plants are all annuals or low herbaceous perennials. The native vegetation has been destroyed during the development of the land for agricultural and pastoral uses over large areas in which climate and soil are suitable, however, and as the preferred food-plants are all able to dominate such areas, although many of them are introduced, conditions favourable for *A. cruciata* have been created. It may be possible to reduce the frequency and severity of outbreaks in these regions by establishing suitable perennial shrubs in them [*cf.* **32** 90].

The complete absence of *A. cruciata* from the region separating the outbreak areas in Western and South Australia is thus due to unfavourable climate, and the non-appearance of swarms in the region separating those of South Australia and New South Wales, where the climate is suitable, to unfavourable soil and vegetation.

CALDWELL (N. E. H.). **Bean Pests in Queensland.**—*Qd agric. J.* **60** pt. 3 pp. 156–171, 25 figs. Brisbane, 1945.

The author gives a key to the insect and other pests that attack beans in Queensland, based on the appearance of the pest and of the injured plants, and descriptions of their bionomics, the damage they cause and their control. *Agromyza phaseoli*, Coq., is particularly injurious to French beans [*cf. R.A.E.*, A **28** 332]. Long beans (*Vigna unguiculata* var. *sesquipedalis*) possess a considerable degree of resistance to attack, at least in the tropics, but young plants sometimes succumb ; if the growing point is killed, a sideshoot frequently develops and a profitable plant is usually produced, and once the first climbing tendrils appear, long beans can withstand very severe infestation. Sword beans (*Canavalia gladiata*) and jack beans (*C. ensiformis*) are apparently not damaged, and the only injury observed in Tonga beans (*Dolichos lablab*) was in the leaf stalk and had little adverse effect on growth. The spray of nicotine sulphate and white oil (1 : 8 : 100) gives satisfactory control in northern Queensland as in the south [*cf.* **28** 333], but the period between applications should be reduced to three days, at least four applications should be given to French beans in winter and spring and six in autumn, and three or four are required on long beans grown in summer. *Aphis* (*Doralis*) *fabae*, Scop., sometimes becomes prevalent, particularly on long beans growing in spring. It causes discoloration of the leaves and retardation of growth, but when the plants have started to climb, they are usually able to maintain a reasonable rate of growth ; malformation of the pods may be caused by large colonies feeding on them, but this type of injury is not common. The Aphids are usually kept under control until flowering time by the spray used against *Agromyza phaseoli*, though thorough application to the under surface of the leaves may be necessary. If a later treatment is required, a 3 per cent. nicotine dust or a spray of ½ pint nicotine sulphate and 2 lb. soft soap in 50 gals. water is effective ; dusts usually give better coverage than sprays on large plants.

The dwarf French bean is apparently the only edible leguminous plant that suffers commercial injury from *Taeniothrips nigricornis*, Schmutz ; it causes curling of the pods by feeding in the flowers when the pods are forming, russetting by feeding on pods approaching maturity, malformation of the young plant by feeding in the growing point, and curling of the leaves by feeding on the undersides. If growing conditions are good, the plants may almost completely recover, but if not, they remain unproductive. Late plants are usually more severely injured than early ones. The eggs are deposited in the tissues of the leaves, flowers or pods, and the nymphs feed in colonies and leave the plant when fully grown to pupate in the soil. The adults live chiefly in the flowers. The spray of nicotine sulphate and white oil controls the thrips in the early stages of growth, and has proved of some value at flowering time, though two applications of a 3 per cent. nicotine dust at an interval of 7–10 days when the plants are in full flower would probably give better results.

Maruca testulalis, Geyer, sometimes causes considerable damage to the pods of all five types of bean, and faulty seed setting of *Canavalia* spp. and *Dolichos* when a heavy infestation occurs in the flowers ; the larvae also burrow in the leaf stalks of French beans. The eggs are apparently laid on or near the flower buds, and the newly hatched larvae enter buds, flowers or pods, though the pods are damaged chiefly by half-grown larvae that have fed on the flowers. Pupation takes place in débris on or near the surface of the ground, and the

adults return to the plants, in which they remain concealed during the day. *Heliothis armigera*, Hb., occasionally feeds on the pods of French beans, and sometimes on the flowers. *Plusia chalcites*, Esp., and *P. argentifera*, Gn., cause similar injury and also destroy a considerable amount of foliage, and *Lampides* (*Jamides*) *phaseli*, Mathew, feeds on the flowers of *Canavalia* spp. and *Dolichos*, as a result of which they do not set seed. Derris dust containing at least 1 per cent. rotenone and a 3 per cent. nicotine dust may be effective, particularly against *M. testulalis* and *L. phaseli*, and weekly applications may be made when these caterpillars are present. A dust containing 50 per cent. lead arsenate gives some control of *H. armigera* and similar pests, but should not be used after the early stages of flowering. The larvae of an unidentified Gracilariid commonly mine in the leaves of the long bean, but growth of vigorous plants is seldom seriously retarded. They are controlled during the early stages of growth by the spray of nicotine sulphate and oil, and later measures have not been necessary.

Nezara viridula, L., causes severe stunting and weakening of the plant, shrivelling and malformation of the young pods and mottling of the older pods on French beans, though damage is usually limited to pod distortion. *Agapophyta bipunctata*, Boisd., *Piezodorus hybneri*, Gmel. (*rubrofasciatus*, F.) and a species of *Oncocoris* are sometimes numerous on long beans, but do not usually cause serious injury when the plants are growing vigorously. *Riptortus serripes*, F., has been recorded as causing a shrivelling of the pods and seeds; both nymphs and adults may be numerous on beans. Control of these bugs by insecticides is unsatisfactory, though the spray of nicotine sulphate and white oil, and a derris spray at about twice the normal strength give partial control. Hand collection of adults, nymphs and eggs is of some value in small areas. The introduced parasite, *Microphanurus basalis*, Woll., which attacks the eggs of *N. viridula*, is widely distributed in Queensland [*cf.* **28** 591], but does not give complete control. Parasitised egg-masses, which are grey instead of pink, should not be destroyed. *Tetranychus telarius*, L. (*urticae*, Koch) attacks the leaves of French beans, long beans and *Canavalia* spp. in spring, and can be controlled by one or more thorough applications of a dust of sulphur and hydrated lime (1 : 1).

The seeds of edible beans, which are frequently stored on the farm from one season to the next, are infested by two Bruchids, of which *Bruchus chinensis*, L., is the usual pest of French beans. The eggs are deposited singly on the seeds, and the larvae feed and pupate in them. There are several generations in the year. Infestation sometimes occurs in the field before the seed is harvested, and treatment should be carried out at the beginning of the storage period. The seed can safely be stored in insect-proof drums if 8 oz. naphthalene or 4 oz. paradichlorbenzene per bushel is mixed with it, or in bags if it is first treated with a mixture of 8 oz. naphthalene and 8 oz. paradichlorbenzene. Mixing it with an inert dust (4 oz. ground dolomite or magnesite per bushel) gives considerable protection.

CALDWELL (N. E. H.). **The Citrus Bud Mite.**—*Qd agric. J* **60** pt. 4 pp. 228–230, 2 figs. Brisbane, 1945.

A bud mite, believed to be *Aceria* (*Eriophyes*) *sheldoni*, Ewing [*cf. R.A.E.*, A **30** 429], has damaged *Citrus* in recent years in widely scattered districts of Queensland. The mites are usually most numerous in unopened flower and leaf buds, but have been observed occasionally on the outside of the buds or on other parts of the trees; they cause distortion of the growing points, leaves, flowers and fruit. Infestation appears to be most widespread on lemons, which are often more injured than other kinds of *Citrus*, but injury is also prevalent on orange and grapefruit; mandarin oranges seem to be much less susceptible, but fairly severe malformation occurs occasionally on almost all kinds of *Citrus*

grown in any district. Damage is most noticeable in spring. It is most important during the first year or two after the trees are planted, when they suffer a severe check and become mis-shapen unless the terminal growth is thinned out. On bearing trees, leader development is checked to some extent on all branches, and pruning is complicated by the need to remove surplus shoots, but usually only a small part of the crop is malformed.

Applications of strong lime-sulphur against *Phyllocoptruta* (*Phyllocoptes*) *oleivorus*, Ashm., and *Unaspis* (*Prontaspis*) *citri*, Comst., in late winter have apparently also controlled the bud mite [*cf.* **30** 231] and the additional lime-sulphur sprays or sulphur dusts often needed during summer to control *Phyllocoptruta* may also be effective against it. Full-strength fumigation with hydrocyanic acid gas is probably also effective, but the low dosages used against *Biprorulus bibax*, Bredd. [**20** 164] give little control, and oil and other sprays used against Coccids on *Citrus* appear to be ineffective. It is recommended, therefore, that a late-winter spray of lime-sulphur (1 : 15) should be included in the spray programmes of all *Citrus* orchards and that further applications should be made, particularly on young trees, if the young growth shows signs of infestation at other times of the year; the strength of this spray should range from 1 : 20 to 1 : 35, depending on temperature. A dust of sulphur and lime (1 : 1) can be substituted for the spring and summer sprays; and it is probable that sprays of colloidal sulphur or wettable sulphur would also be effective. Infestation of young trees in the nursery has not been observed, but if it is found, the trees should be sprayed thoroughly with lime-sulphur at as great a strength as is safe at the prevailing temperature.

SWEETMAN (H.), WARNER (C. L.) & HERSHBERG (B. J.). **Insect Repellency Testing. The Testing of Fabrics and Papers for Attractiveness to Thysanura and Roaches before and after deterrent Applications.**—*Soap* **21** no. 3 pp. 104–107, 127, 129, 131, 7 figs., 19 refs. New York, N.Y., 1945.

The literature on the development of methods of testing the attractiveness of fabrics and papers to insects is reviewed. The common Lepismids that infest buildings and damage paper and fabrics in the United States are *Lepisma saccharina*, L., *Ctenolepisma quadriseriata*, Pack., *C. urbana*, Slabaugh, and *Thermobia domestica*, Pack. [*cf. R.A.E.*, A **33** 106]. These and cockroaches seldom injure wool, hair or cotton fibres, but are very injurious to certain synthetic fibres and papers. The finishes added to fibres may also render them attractive. Tables are given showing the feeding responses of three of the Lepismids to synthetic fabrics and finishes.

Procedure for testing the attractiveness of fabrics and paper to Lepismids and cockroaches and the effect of repellents should be quick and simple. More damage is caused by nearly mature Lepismids and large nymphs or young adults of cockroaches than by smaller individuals. In the case of Lepismids, 25–30 should be used for one week, 15–20 for 10 days or 10 for two weeks, and in the case of cockroaches, 20–30 for 7–10 days. Optimum temperatures are 27°C. [80·6°F.] for *Lepisma*, 30°C. [86°F.] for *Ctenolepisma*, 37°C. [98·6°F.] for *Thermobia* and 24–28°C. [75·2–82·4°F.] for cockroaches; a relative humidity of 75–85 per cent. is best for Lepismids and one of 80–95 per cent. for cockroaches. Direct sunlight is undesirable. In tests of toxicity, repellency or possible damage, no food other than the sample should be available, but to test probable damage, other suitable food should be provided. Cages 5–10 ins. wide with smooth, nearly vertical sides, without a cover if there is danger of injurious fumes, are suitable for Lepismids and cages 6–12 ins. wide with a gauze cover, or a solid cover if there is no danger of injurious fumes, are suitable for cockroaches. Overcrowding must be avoided. The test sample should measure 1 in. square for Lepismids and small cockroaches and 1 × 2 ins. for large cockroaches. Each test should be made in duplicate or triplicate.

Measurement of damage by visual examination with a ruled glass plate proved quite satisfactory. Weighing the sample after reducing the moisture content to a constant figure is an alternative, but by this method concentrated damage on a small portion of the sample might give a figure similar to general surface injury on another sample. As Lepismids and cockroaches are surface feeders, measurement of the extent of the surface damaged is important. Feeding confined to isolated areas suggests contamination. Mortality should be recorded, as, if it is high, the test cannot be considered reliable.

BIERIG (A.). **Combate del ahogapollo.** [The Control of Lamellicorns.]—*Bol. téc. Cent. nac. Agric. Costa Rica* no. 29, 13 pp., 1 fig. San José de Costa Rica, 1942.

Lamellicorn beetles are a pest of various crops in Costa Rica, including orange and other forms of *Citrus*, since they not only feed on the leaves but also destroy the flowers. The commonest of them in the central region is the Melolonthid, *Macrodactylus suavis*, Bates, but other species of this genus and species of *Hoplia* and *Anomala* are also involved. The larvae of all of them feed on roots in the soil. The adults of *M. suavis*, which are described, emerge from the soil from May onwards, after rains, and feed and pair on hot days, and the females lay about 30 eggs each in the soil. The males die soon after pairing, but the females survive for about a month. In tests on control, arsenical sprays and dusts were of little use and the best method was to jar the beetles from the branches into a net and destroy them.

PAPERS NOTICED BY TITLE ONLY.

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